Philipps Universität Marburg

Evaluation psychometrischer Verfahren zur Verbesserung der Diagnostik von ADHS im Kindes-, Jugend- und Erwachsenenalter

Dissertation zur Erlangung des Doktorgrades der Naturwissenschaften (Dr. rer. nat.) am Fachbereich Psychologie der Philipps-Universität Marburg

vorgelegt von

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geb. am 05.01.1978 in Karlsruhe

Marburg im Februar 2017

Fachbereich Psychologie der Philipps-Universität Marburg
(Hochschulkennziffer 1180)

Einreichung der Dissertation: 07.02.2017
Annahme der Dissertation: 02.05.2017

Erstgutachter: Prof. Dr. Hanna Christiansen
Zweitgutachter: Prof. Dr. Bernd Röhrle

Danksagung

Zunächst gilt mein Dank meiner Doktormutter Frau Prof. Hanna Christiansen für ihre Unterstützung in nahezu allen Bereichen, sei es in wissenschaftlicher, motivationaler oder emotionaler Hinsicht. Danke für Deine Flexibilität und scheinbar nie enden wollende Geduld.

Vielen Dank an Herrn Prof. Bernd Röhrle der mich während des Studiums mit seiner Begeisterung für die vielfältigen Möglichkeiten psychotherapeutischer Arbeit anstecken konnte, schon Zweitgutachter meiner Diplomarbeit war und mittlerweile seit knapp zehn Jahren meinen Lebensweg beeinflusst (obwohl ihm das wahrscheinlich gar nicht bewusst ist).

Weiterhin danke ich Herrn Prof. Winfried Rief für die einmalige Chance im Rahmen des Marburger Modells psychotherapeutische und wissenschaftliche Arbeit zu kombinieren sowie allen Mitstreitern und Mitarbeitern der Arbeitsgruppe Klinische Psychologie und Psychotherapie für die Unterstützung und die angenehme Zusammenarbeit. Ein besonderer Dank geht an Verena Reh, mit der ich im Rahmen des Neurofeedback-Projekts zusammenarbeiten durfte und die mich besonders durch ihre Zielstrebigkeit und strukturierte Arbeitsweise immer wieder beeindruckt hat. Außerdem waren die gemeinsamen Fahrten nach Wetter immer eine große Freude!

Auch möchte ich an dieser Stelle meinen Eltern Irene und Manfred Schmidt danken, die die - zum damaligen Zeitpunkt - hahnebüchen erscheinende Idee eines Psychologiestudiums unterstützt haben und die mir bis heute in jeder problematischen Lebenslage Struktur und Halt geben. Durch Euch wurde mir bewusst, dass man unangenehme Aufgaben manchmal einfach erledigen muss, wirklich gut aber nur in den Dingen wird, deren Ausübung einem auch Freude bereitet.

Ein großes Danke gilt meiner Frau Simone, die die turbulenten letzten Jahre an meiner Seite gestanden, mir immer wieder Freiräume zum Arbeiten geschaffen, mich immer wieder gefordert, beratschlagt und motiviert hat (und dies auch hoffentlich weiterhin tun wird). Die mir zudem schon zwei wundervolle Kinder und somit auch die dringend benötigte Struktur in meinem Leben geschenkt hat.

Abschließend möchte ich meinem - kurz vor Ankunft stehenden - Sohn dafür danken, dass er mich dazu gezwungen hat diese Arbeit fertig zu stellen, da er sicherlich einen (rechtmäßigen) Anspruch auf einen bedeutenden Teil der mir zur Verfügung stehenden Zeit erheben wird.

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1 Zusammenfassung und Abstract

1.1 Zusammenfassung

Bei der Aufmerksamkeitsdefizit–/Hyperaktivitätsstörung (ADHS) handelt es sich um eine der weltweit häufigsten psychischen Störungen mit Beginn im Kindes- und Jugendalter,welche oft bis ins Erwachsenenalter hinein persistiert. Die aus den Kernsymptomen Unaufmerksamkeit, Hyperaktivität und Impulsivität entstehenden Verhaltens- und Erlebensweisen verursachen bedeutsames Leiden bei Betroffenen, deren Familien sowie deren schulischem bzw. beruflichem Umfeld. Weiterhin ist die Wahrscheinlichkeit der Entwicklung komorbider psychischer Störungen bei von ADHS betroffenen Menschen deutlich erhöht, was den Leidensdruck der Betroffenen und des Umfeldes zusätzlich intensiviert. In diesem Zusammenhang wird die massive Belastung der Gesundheitssysteme durch ADHS deutlich.

Eine zuverlässige Diagnostik der Störung im Kindesalter ist aufgrund der Überlappung der Kernsymptomatik der ADHS mit zentralen Symptomen anderer psychischer Störungen (beispielsweise Konzentrationsschwierigkeiten bei Depressionen), vor allem in Hinblick auf die noch eingeschränkte Introspektionsfähigkeit jüngerer Kinder und die hohe Reaktivität von Kindern und Jugendlichen auf Störungen der familiären Strukturen (im Sinne des Indexpatienten der systemischen Therapie), äußerst anspruchsvoll. Mit zunehmendem Alter besteht bei bis dato unentdeckter ADHS zudem das Risiko der Entwicklung einer komorbiden psychischen Erkrankung, die die zugrunde liegende Störung gegebenenfalls überdeckt. Diagnostische Instrumente müssen demzufolge einerseits ein hohes Maß an Sensitivität für die Erfassung der Symptomatik, andererseits ein hohes Maß an Spezifität in Abgrenzung zu problematischen Verhaltens- und Erlebensweisen, welche besser durch andere psychische Störungen oder problematische Lebensumstände erklärt werden können, aufweisen. Im Rahmen der länderübergreifenden Forschung wird weiterhin deutlich, dass es kulturelle Unterschiede bei der Beurteilung der Qualität und Intensität von ADHS-Kernsymptomen gibt, also welches Verhalten vom sozialen Umfeld als „problematisch“ erlebt wird. Beispielsweise berichten in Deutschland lebende Familien mit Migrationshintergrund insgesamt häufiger ADHS-Symptome ihrer Kinder, die aber wiederum seltener diagnostiziert werden (Huss et al., 2008).

In diesem Zusammenhang muss also überprüft werden, ob sich ein psychometrisches Testverfahren zur Diagnose der ADHS für eine möglichst große Population als ausreichend

valide und reliabel erweist, oder ob es eventuell an Subgruppierungen (bspw. nach Geschlecht oder kulturellem Hintergrund) entsprechend angepasst werden muss.

Selbst- und Fremdbeurteilungen von Verhalten und Erleben mithilfe von Fragebögen zählen zu den am häufigsten eingesetzten Verfahren zur Erfassung von ADHS-Symptomen, sowohl im Kinder- als auch Erwachsenenalter, weswegen sich der **erste Artikel (Schmidt, Reh, Hirsch, Rief, & Christiansen, 2013)** dieser Arbeit den möglichen Einflüssen kultureller Variation auf die Zuverlässigkeit der Conners-3 Skalen (Conners, 2008), einem verbreiteten Fragebogen zur Erfassung von ADHS im Kindesalter, widmet. Zu diesem Zweck wurde eine Gruppe in Deutschland lebender Kinder mit türkischem Migrationshintergrund, sowie deren Eltern und Lehrer, untersucht. Die Auswertung der Daten ergab keinen relevanten Einfluss der Akkulturation bei der Bewertung der Symptome der Kinder, und zwar unabhängig davon ob die Beurteilung durch die Eltern oder die Lehrer stattfand. Zudem bestätigte die konfirmatorische Faktorenanalyse die Faktorenstruktur der amerikanischen Originalversion. Insgesamt scheinen die Conners-3 Skalen resistent gegenüber potentiellen Verzerrungen im Rahmen kultureller Variation zu sein, was für eine Eignung bei der Beurteilung von ADHS-Symptomen, unabhängig vom kulturellen Hintergrund der Kinder, spricht.

Die retrospektive Diagnose von ADHS im Erwachsenenalter, einer Entwicklungsstörung mit Beginn in der Kindheit, wird durch die Überlappung der Kernsymptome mit derer verschiedener anderer psychiatrischer Störungen erschwert, beispielsweise Konzentrations-/Aufmerksamkeitsproblemen bei Depressionen oder Impulsivität bspw. bei Substanzbezogenen- und Verhaltenssüchten oder auch der Borderline-Persönlichkeitsstörung. Der **zweite Artikel (Schmidt, Müller-Reh, Müller, Meyer, Rumpf & Christiansen**) befasst sich mit der Problematik der Differentialdiagnostik von ADHS im Erwachsenenalter. Zu diesem Zweck wurde die Kurzversion der Conners Adult ADHS Rating Scales (CAARS-S), sowohl einer Gruppe von ADHS betroffenen Erwachsenen, als auch Probanden, welche von einer anderen mit mangelnder Impulskkontrolle assoziierten Störungen betroffen waren, vorgelegt. Die Ergebnisse der statistischen Auswertungdeuten auf eine insgesamt gute Eignung der CAARS-S hin, zwischen diesen Störungsbildern adäquat zu differenzieren. Im Besonderen gilt dies für die Subskala ADHS-Index, deren alleinige Verwendung eine Genauigkeit der Zuordnung von immerhin 82,5% aufwies.

Die leitliniengerechte Diagnostik von ADHS empfiehlt neben der Verwendung von Fragebögen auch den Einsatz neuropsychologischer Verfahren. Diese bieten den Vorteil einer stark erhöhten Objektivität gegenüber Fragebögen und klinischen Interviews bei der

Erfassung der ADHS-Kernsymptomatik. Bislang fehlt es diesen Verfahren jedoch an ausreichend hoher Spezifität zur Differenzierung von ADHS und anderen klinischen Störungsbildern. Der Quantified Behavior-Test (Qb-Test; Ulberstad, 2012) ist, im Gegensatz zu herkömmlichen neuropsychologischen Verfahren, welche sich meist auf die Erfassung von Aufmerksamkeitsdefiziten und behavioraler Impulsivität beschränken, mit Hilfe einer Infrarotkamera in der Lage, auch die Bewegungen des Probanden während der laufenden Testung und somit motorische Auffälligkeiten zu erfassen. Faktorstruktur und psychometrischen Eigenschaften des Qb-Tests sind Thema des **dritten Artikels (Reh, Schmidt, Lam, Schimmelmann, Hebebrand, Rief & Christiansen, 2013)**. Die mit einer großen Stichprobe durchgeführte explorative Faktorenanalyse identifizierte eine drei-faktorielle Struktur, die mit den ADHS-Kernsymptomen übereinstimmt. Dies ist ein erster Schritt zu einer Verbesserung der bestehenden objektiven neuropsychologischen Verfahren mit Hilfe des Qb-Tests.

Insgesamt sprechen die vorliegenden Studienergebnisse für folgende Aussagen: 1.) die Conners-3 Skalen sind resistent gegenüber Verzerrungen durch kulturelle Variabilität und somit für den Einsatz in internationalen Studien zu ADHS geeignet; 2.) die Conners Adult ADHD Rating Scales, insbesondere die Subskala ADHS-Index, differenzieren ausreichend gut zwischen ADHS im Erwachsenenalter und anderen psychischen Störungen, welche mit einer Störung der Impulskontrolle assoziiert sind; und 3.) die ermittelte Faktorenstruktur des Qb-Tests spricht dafür, dass eine Verbesserung der objektiven Erfassung von ADHS-Kernsymptomendurch dieses Verfahren erreicht werden kann.

Die Ergebnisse der Arbeiten liefern somit einen Beitrag zur Verbesserung der Diagnostik von ADHS im Kindes- und Erwachsenenalter.

1.2 Abstract

Attention Deficit/Hyperactivity Disorder (ADHD) is one of the most common psychological disorders with onset in childhood and adolescence that often persists into adulthood. Its core symptoms inattention, hyperactivity and impulsivity cause significant suffering among those affected, as well as for their families and school or professional environment. Furthermore, the likelihood of developing comorbid mental disorders is significantly increased. Healthcare systems of affected countries are massively strained. A reliable diagnosis of the disorder in childhood is a challenging task due to overlap of symptoms of ADHD with central symptoms of other mental disorders (e. g. difficulties concentrating in depression). Other problems are

the limited introspective abilities of young children and the high reactivity of children and adolescents concerning dysfunctional family structures. With increasing age an undiagnosed ADHD also increases the risk of developing a comorbid mental illness that might cover the underlying disorder. Diagnostic instruments must therefore have a high degree of sensitivity for the detection of symptoms specific for ADHD, while simultaneously displaying a high degree of specificity towards problematic behavior that might more accurately be associated with other mental disorders or contexts. Transnational research showed that there are some serious cultural differences in assessing the quality and intensity of ADHD core symptoms, in terms of what kind of behavior is experienced as "problematic" by the social environment. Therefore, it is a necessity to verify whether a psychometric test for the diagnosis of ADHD is sufficiently valid and reliable when administered to the widest possible population, or whether it has to be tailored to specific subgroups (e. g. gender or varying cultural backgrounds). Self- and external assessment questionnaires are among the most commonly used method for detecting ADHD symptoms, both in children and adults, which is why the **first paper (Schmidt, Reh, Hirsch, Rief & Christiansen, 2013)** of this work is dedicated to test the possible influences of cultural variation on the reliability of the Conners-3 scales (Conners, 2008), a popular questionnaire for the assessment of ADHD in childhood. To achieve this, we examined a group of children with Turkish migration background living in Germany, as well as their parents and teachers. The analysis of the data showed no relevant influence of acculturation when assessing the symptoms of children, regardless whether the assessment was done by the children, their parents or their teachers. In addition, the confirmatory factor analysis confirmed the factor structure of the original US version. Overall, the Conners-3 scales seem to be resistant to distortion through cultural variation, which recommends their suitability when assessing ADHD symptoms, regardless of cultural background.

Retrospective diagnosis of adult ADHD, a developmental disorder with onset in childhood, is complicated as its core symptoms overlap with those of several other psychiatric disorders, such as depression (concentration/attention problems) or behavioral and substance-related addictions as well as Borderline Personality Disorder (impulsivity). The **second paper (Schmidt, Müller-Reh, Müller, Meyer, Rumpf & Christiansen)** thus deals with the problems of differential diagnosis of adult ADHD. To this end, the short version of the Conners Adult ADHD Rating Scales (CAARS-S; Conners, 2010) was presented to both a group of adults affected by ADHD, as well as subjects who were affected by other disorders associated with a lack of impulse control. The results of the statistical analyses indicate a good overall suitability of the CAARS-S to adequately differentiate between these clinical

pictures. This applies in particular for the subscale *ADHD Index*, which achieved an accuracy rating of 82.5%.

A guideline-based diagnosis of ADHD not solely relies on questionnaires but uses the assessment of neuropsychological processes as well. In contrast to questionnaires and clinical interviews these offer the advantage of substantially increased objectivity when assessing core ADHD symptoms, although this method currently lacks sufficiently high specificity for differentiation of ADHD and other clinical disorders. The Quantified Behavior Test (Qb-Test; Ulberstad, 2012) - in contrast to conventional neuropsychological methods that are mostly limited to the detection of attention deficit and behavioral impulsivity - uses an infrared camera capable to capture the movements of the subject during the testing, and thus is able to detect motor abnormalities. Factor structure and psychometric properties of the Qb-Test are subjects of the **third paper (Reh, Schmidt, Lam, Schimmelmann, Hebebrand, Rief & Christiansen, 2013)**. An exploratory factor analysis conducted with a large sample identified a three-factor structure that matched the ADHD core symptoms. This is a first step towards improving the existing objective neuropsychological procedures using the Qb-Test. On the basis of the study results the following statements are made: 1.) the Conners-3 scales are resistant to distortion by cultural variability and thus suitable for use in international studies on ADHD; 2.) the Conners Adult ADHD Rating Scales, especially the subscale *ADHD Index*, differentiate adequately between adult ADHD and other problematic behaviors, associated with impulse control; and 3) the determined factor structure of the Qb-Test suggests that an improvement in the objective assessment of ADHD core symptoms can be achieved using this method. Altogether this work contributes to the improvement of current processes when assessing ADHD in children and adults.

2 Einführung

Thema dieser Dissertation sind Besonderheiten und Herausforderungen der Diagnostik von ADHS im Kindes- und Erwachsenenalter. Nach einer Einführung in Symptomatik, Prävalenz und Ätiologie der Störung, folgen Informationen zu derzeitigen Standards bei der Diagnostik von ADHS im Kindes- und Erwachsenenalter und Vorstellungen der in den Studien verwendeten Messinstrumente. Anschließend folgen Abschnitte zu Verlauf der Störung, häufigen Komorbiditäten und gängigen Behandlungsansätzen. Dann werden Zielsetzungen und methodische Vorgehen der einzelnen Studien beschrieben. Nachdem Vor- und Nachteile der Arbeit diskutiert wurden, folgt abschließend ein Ausblick auf weitere Forschungsfragen.

2.1 Symptomatik der Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS)

Bei der Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS) handelt es sich um eine neurobiologische Entwicklungsstörung, die der Gruppe der Verhaltens- und emotionalen Störungen mit Beginn in der Kindheit und Jugend zugeordnet wird. Die Kernsymptome umfassen erhöhte motorische Aktivität, Impulsivität und Unaufmerksamkeit. Die Symptome müssen bereits in der Kindheit bestehen und für das entsprechende Alter unverhältnismäßig stark ausgeprägt sein. Die Begriffe *Minimale Cerebrale Dysfunktion* (MCD) und *Psychoorganisches Syndrom* (POS) sind mittlerweile veraltete Bezeichnungen für ADHS (Krause, 2014). Das heutige Konzept, wie in DSM-IV bzw. DSM-5 (DSM-IV; DSM-5; American PsychiatricAssociation, 2000, 2013) und ICD-10 beschrieben (ICD-10 Kapitel V (F); World Health Organisation (WHO), Dilling, Mombour, & Schmidt, 2009) ist recht neu, allerdings gibt es bereits seit 200 Jahren Literatur, die Kinder mit derartigen Verhaltensauffälligkeiten beschreibt (Lange, 2010). Schon 1798 beschrieb Sir Alexander Crichton einen Zustand, der gekennzeichnet war von geistiger Unruhe und der Unfähigkeit, sich mit einem ausreichenden Grad an Aufmerksamkeit einer Tätigkeit zu widmen. Dieser Zustand manifestiere sich bereits in der Kindheit, habe einen ungünstigen Einfluß auf das Lernverhalten und verschwinde zumeist mit Eintritt in das Erwachsenenalter. Auch Heinrich Hoffmann, Autor der weltweit bekannten Geschichte vom Zappel-Phillip, beschreibt knapp 100 Jahre später (1884) die Kernsymptome einer ADHS. 1902 beschrieb der englische Kinderarzt George Frederic Still dann das Störungsbild erstmals wissenschaftlich und erwog die These, dass nicht ungünstige Umweltbedingungen oder eine schlechte Erziehung für die Symptomatik verantwortlich seien, sondern eine „ernsthafte cerebrale Störung in früher

Kindheit“. In den 1970er Jahren begann die Erforschung der neurobiologischen Grundlagen von ADHS (Lange, 2010).

Laut DSM-5 (APA, 2013) müssen von ADHS Betroffene (Kinder, Jugendliche und Erwachsene) mindestens in einer von zwei Kategorien – *Unaufmerksamkeit* und *Hyperaktivität/Impulsivität* – Auffälligkeiten zeigen. Für jede Kategorie gilt, dass eine Mindestanzahl spezifischer Symptome vorliegen muss (bspw. „Scheint oft nicht zuzuhören, wenn direkt angesprochen.“, „Verlässt oft seinen Platz in Situationen, wo dies stört.“) um eine Diagnose zu rechtfertigen. Somit sind nach DSM drei *Ausprägungen (presentations)* einer ADHS möglich: die *vorwiegend unaufmerksame Ausprägung*, die *vorwiegend hyperaktiv-impulsive Ausprägung* und die *kombinierte Ausprägung*. Die beiden einseitigen Ausprägungen („vorwiegend“) sind dann zutreffend, wenn die geforderte Zahl von Symptomen nur für eine der beiden Kategorien vorliegt. Zudem wird im DSM-5 der Schweregrad der Störung angegeben (leicht, mittel, schwer).

Für die Diagnosestellung der ADHS nach ICD-10 (F90.0) müssen ausreichend viele Symptome aus den drei Bereichen a) beeinträchtigte Aufmerksamkeit b) Überaktivität und c) Impulsivität vorhanden sein. Eine Diagnose mit vorwiegenden Problemen in nur einem Bereich, wie im DSM-5, ist bisher nicht möglich, wobei ADHS im Entwurf für die Neufassung der ICD (ICD-11) mittlerweile ähnlich konzeptualisiert wird wie im DSM-5. Das ICD-10 wiederum grenzt die einfache Aktivitäts- und Aufmerksamkeitsstörung (F90.0) von der hyperkinetischen Störung des Sozialverhaltens (F90.1) ab und berücksichtigt somit die am häufigsten komorbid auftretende Störungskategorie bei ADHS.

Sowohl nach ICD-10 als auch nach DSM-5 müssen die Symptome über einen Zeitraum von mindestens sechs Monaten vorliegen, ein unangemessenes, nicht mit dem Entwicklungsstand des Kindes zu vereinbarendes Ausmaß haben und kontextübergreifend auftreten. Zudem muss die Störung vor dem siebten (DSM-IV; ICD-10) bzw. zwölften Lebensjahr (DSM-5) aufgetreten sein und deutliches Leiden oder eine deutliche Beeinträchtigung der sozialen, schulischen oder beruflichen Funktionsfähigkeiten verursachen.

2.2 Prävalenz

Eine Metaanalyse von Polyanzcket al. (2014), die eine Vielzahl von Studien und über 170.000 Probanden umfasste, kam zu dem Ergebnis, dass die weltweite Prävalenz von ADHS für Schulkinder bei etwa 7 % liegt. Die verbreitete Annahme, es gäbe eine Zunahme von

Diagnosen in den letzten Jahrzehnten, lies sich nicht bestätigen. Auch zeitliche oder regionale Unterschiede in der Prävalenz ließen sich für den Zeitraum zwischen 1985 bis 2012 nicht nachweisen, diese seien lediglich durch methodische Unterschiede in der jeweiligen Erhebung entstanden. Hinsichtlich der Prävalenz zeigten sich keine bedeutsamen Unterschiede zwischen einzelnen Ländern oder Regionen, wenn die Kriterien zur Diagnosestellung statistisch kontrolliert wurden. Insbesondere methodische Unterschiede, die verwendeten diagnostischen Kriterien und die geforderte klinische Beeinträchtigung führten zu Schwankungen der Prävalenzangaben.

Laut Kinder- und Jugendgesundheitssurvey (KiGGS; Schlack, 2007), einer großangelegten epidemiologischen Studie mit 14.836 Teilnehmern, waren insgesamt 4,8% der Kinder und Jugendlichen in Deutschland zwischen Mai 2003 bis Mai 2006 von einer diagnostizierten ADHS betroffen (1,5% der Kinder im Vorschulalter, 5,3 % der Kinder im Grundschulalter, 7,1 % der Jugendlichen im Alter von 11–13 Jahren und 5,6 % der 14 bis 17-Jährigen). Weitere 4,9 % der Studienteilnehmer zeigten entsprechende Auffälligkeiten, erfüllten aber nicht das Vollbild einer ADHS. Jungen waren dabei über alle Altersklassen hinweg deutlich häufiger betroffen als Mädchen; die APA (2000) schätzt ein Verhältnis von 3:1. Zudem sagte ein niedriger sozioökonomischer Status (SÖS) signifikant mehr und ein Migrationshintergrund der Eltern signifikant weniger ADHS-Diagnosen vorher. Bei 30–50 % der im Kindes- und Jugendalter Betroffenen persisitiert die ADHS zudem bis in das Erwachsenenalter hinein.

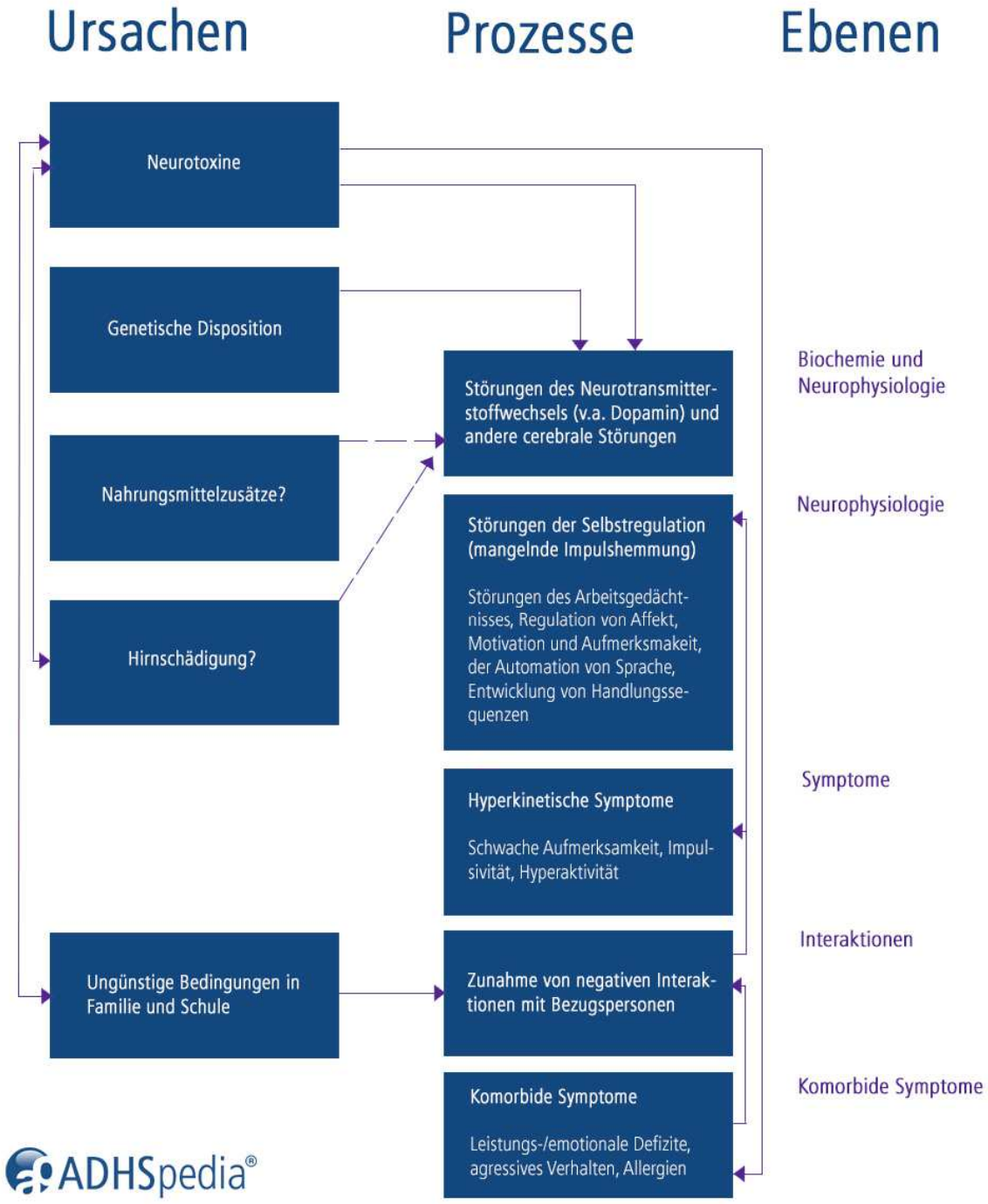
Nach Wilcutt et al. (2012) dominiert bei Vorschulkindern meist ein hyperaktiv-impulsives Verhalten ohne ersichtliche Aufmerksamkeitsstörung. Aufmerksamkeitsdefizite treten erst mit zunehmendem Alter in Erscheinung, während die motorische Unruhe abnimmt. Bei Erwachsenen steht dann primär dieAufmerksamkeitsstörung ohne ausgeprägte Hyperaktivität, im Vordergrund. ADHS im Erwachsenenalter ist in der Regel durch Unaufmerksamkeit, Gedächtnisprobleme, Schwierigkeiten am Arbeitsplatz, Prokrastination und Problemen bei der Strukturierung des Alltags gekennzeichnet. Diese Schwierigkeiten betreffen meist verschiedene Lebensbereiche, und haben emotionale, soziale, finanzielle, eheliche, rechtliche, berufliche und / oder schulische Probleme zur Folge. Dies wirkt sich in Folge oft auch negativ auf den Selbstwert des Betroffenen aus (Gentile, 2006).

2.2.1 Kulturelle Variation

Trotz des Einsatzes einheitlicher Erhebungskriterien und -verfahren, scheint es kulturelle Unterschiede in der Wahrnehmung und Beurteilung von hyperaktivem oder störendem Verhalten zu geben. Die IMAGE Studie (International Multicenter ADHD Genetics Project, IMAGE; Kuntsi, Neale, Chen, Faraone, & Asherson, 2006), eines der größten internationalen Forschungsprojekte zu ADHS, mit über 1000 teilnehmenden Familien in 11 europäischen Ländern, fand trotz standardisierter Verfahren und Abläufe in den Studienzentren signifikante Unterschiede in der mittleren Anzahl berichteter ADHS-Symptome zwischen den einzelnen Ländern (Müller et al., 2011a). Dies bekräftigt den Verdacht, dass kulturelle Unterschiede die Erfassung von ADHS beeinflussen. Wenngleich ADHS eine primär genetisch-biologisch verursachte Störung mit einer weltweiten Prävalenz von etwa 5 % ist (Wilcutt, 2012; Polanczyk et al., 2007), scheint die Beurteilung dessen, was als problematisches Verhalten gesehen wird, über Länder, Ethnien und Kulturen hinweg zu variieren. Die Vernachlässigung des Einflusses kultureller Variation auf den diagnostischen Prozess könnte dazu führen, dass diagnostische Algorithmen und Cut-Offs für Subgruppen, wie beispielsweise Menschen mit Migrationshintergrund, ungeeignet sind (Canino & Alegría, 2008). Hierfür sprechen Befunde von Huss et al. (2008) die zeigten, dass in Deutschland lebende Familien mit Migrationshintergrund gleichzeitig weniger ADHS-Diagnosen berichten, jedoch mehr ADHS-Symptome. Die allgemeine Prävalenz von ADHS bei Kindern liegt in Deutschland bei 5.1 %, während sie in Familien mit Migrationshintergrund mit 3.1 % signifikant niedriger ist (Schlack et al., 2007). Dies könnte neben kulturellen Unterschieden wie einem abweichenden Hilfesuchverhalten sowie einer höheren Toleranz gegenüber ADHS-Symptomen auch an einer Inkompatibilität der in Deutschland gängigen und an deutschen Stichproben evaluierten diagnostischen Verfahren liegen. Laut dem Auswärtigen Amt (Federal Office for Migration and Refugees Federal Ministry of the Interior, 2013) leben in Deutschland aktuell etwa drei Millionen Menschen aus der Türkei und bilden damit die größte Gruppe mit Migrationshintergrund hierzulande. Menschen mit niedrigerem Akkulturationsniveau (d.h. schlechter integrierte Menschen) haben signifikant niedrigere Einkommen, weniger deutsche Freunde, schlechtere Sprachkenntnisse und ein niedrigeres Bildungsniveau als Menschen mit Migrationshintergrund, die besser integriert sind (Kiss & Kreienbrink, 2010). Mit der beschriebenen Problematik und der Frage nach dem Einfluss kultureller Variation auf die Erfassung von ADHS-Symptomen, beschäftigt sich auch der erste Artikel dieser Arbeit.

2.3 Ätiologie

Das biopsychosoziale Störungsmodell (Döpfner, 2006) beschreibt die Entstehung von ADHS multifaktoriell, d. h. als Folge des Zusammenwirkens verschiedener Faktoren auf verschiedenen Ebenen. Das Modell postuliert eine genetische Disposition sowie spezifische Umweltfaktoren als ursächlich für die Entwicklung der Störung. Weiterhin scheinen Wechselwirkungen von Genetik und Umwelt (Epigenetik) den Verlauf der Erkrankung zu beeinflußen.



Die Vermutung, ADHS sei die Folge einer Hirnschädigung oder von Nahrungsmittelunverträglichkeiten, gilt mittlerweile als weitgehend widerlegt (Cormier, 2008). Die bedeutende Rolle der Genetik bei der Entstehung von ADHS gilt als gesichert (Faraone & Biederman, 2005; Zhou et al., 2008). Ungünstige Umweltbedingungen scheinen nicht primär die Ursache der Entwicklung einer ADHS zu sein, Schweregrad und Chronifizierung der Störung jedoch substantiell zu beeinflußen. Zudem erhöhen ungünstige Umweltbedingungen die Wahrscheinlichkeit der Genese komorbider Probleme (Biederman, 2005).

2.4 Neuropsychologische Befunde

Die neuropsychologischen Beeinträchtigungen bei ADHS betreffen sowohl Aufmerksamkeitsintensität und -selektivität als auch exekutive Funktionen. Aufmerksamkeitsselektivität („Alertness“) beschreibt die Fähigkeit, den Fokus schnell auf einen neuen oder unerwarteten Reiz auszurichten (Nigg et al., 2008), während Aufmerksamkeitsintensität („Vigilance“) die Fähigkeit bezeichnet, diesen Fokus über längere Zeit hinweg aufrecht zu erhalten (Oken et al., 2006). In Meta-Analysen zeigte sich, dass von ADHS betroffene Probanden langsamer auf einen Zielreiz reagieren („Alertness“) und mehr Auslassungsfehler in CPTs machen („Vigilance“) als Probanden ohne ADHS (Frazier et al., 2004; Willcutt et al., 2005).

Forschung zu Exekutiven Dysfunktionen (ED) bilden den größten Teil der Forschung zur Neuropsychologie der ADHS. Dies umfasst kognitive Prozesse wie Inhibitionskontrolle, Arbeitsgedächtnis und kognitive Flexibilität (Marcovitch & Zelazo, 2009). Betroffene Kinder zeigen langsamere und variablere Reaktionszeiten sowie erhöhte Fehlerraten verglichen mit gesunden Kontrollprobanden (Andreou et al., 2007; Doyle et al., 2005; Drechsler et al., 2005; Epstein et al., 2003; Scheres et al., 2001; Uebel et al., 2010). Impulsfehler dienen hierbei als Marker für behaviorale Impulsivität (Egeland et al., 2010a, 2010b; Nichols et al., 2004; Slaats-Willemse et al., 2003; Willcutt et al., 2005); langsamere, variablere Reaktionszeiten und Auslassungsfehler als Marker für Störungen der Aufmerksamkeit (McGee et al., 2000; Nichols et al., 2004). Es scheint jedoch nicht die Kapazität der Aufmerksamkeit, sondern der selbstgesteuerte, kontrollierte Einsatz der Aufmerksamkeit bei ADHS-Kindern gestört zu sein (Albrecht et al., 2008). Eine Meta-Analyse von Willcutt et al. (2005) bestätigt die Bedeutung Exekutiver Dysfunktionen für die Ätiologie der ADHS, da sich betroffene Kinder auch nach Kontrolle von Variablen wie Intelligenz, Bildung oder Symptomen anderer Störungen

signifikant von Kontrollprobanden unterschieden. Obwohl von ADHS betroffene Kinder grundsätzlich schlechtere Leistungen in den Exekutiven Funktionen zeigen als gesunde Kontrollen, sind diese Einschränkungen nicht gleichermaßen bei allen Betroffenen ausgeprägt (Willcutt et al., 2005), weswegen ein spezifisches neuropsychologisches Profil bislang nicht ermittelt werden konnte. Kinder mit ADHS scheinen sich von nicht-betroffenen Kindern zudem in ihrer Fähigkeit strategisch zu planen zu unterscheiden, da sie in entsprechenden Aufgaben (Tower of Hanoi, Tower of London, PorteusMaze, ROCF) durchgehend schwächer abschneiden (Papadopoulos et al. 2005).

2.5 Diagnostik

Aufgrund der Heterogenität des Störungsbildes und der Überschneidungen mit Symptomen anderer Erkrankungen sollte die Diagnose einer ADHS auf Basis der Informationen unterschiedlicher Quellen erfolgen, da einzelne Tests oder Auffälligkeiten in einem einzigen Kontext nicht ausreichen, um differenzialdiagnostisch saubere Einschätzungen zu treffen. Die Berücksichtigung verschiedener Informationsquellen, die Verwendung geeigneter diagnostischer Verfahren (bspw. strukturierter klinische Interviews, Selbst- und Fremdbeurteilungsfragebögen) und Verhaltensbeobachtung gehören nach den internationalen Leitlinien zur Diagnostik und Therapie von ADHS im Kindesalter (American Academy of Child and Adolescent Psychiatry, 2007) zum Standard bei der Diagnose. Aufgrund der hohen Subjektivität dieser Methoden und der damit einhergehenden erhöhten Anfälligkeit für Verzerrungen (Edwards et al., 2007), gehört neben der Befragung des betroffenen Kindes, der Eltern, Erzieher und Lehrkräfte, zudem eine umfassende neuropsychologische Testdiagnostik sowie eine neurologische Untersuchung (EEG, MRT) zum grundlegenden diagnostischen Prozess. Computerbasierte, neuropsychologische Tests gelten als objektive, reliable und normierte Verfahren und sind somit elementare Ergänzungen zu den etablierten Verfahren. Eine reine Konzentrationstestung ist hier nicht ausreichend. Derzeit zur Diskussion stehende quantifizierbare Merkmale für die Diagnose von Kindern mit ADHS umfassen Einschränkungen des Arbeitsgedächtnisses, Beeinträchtigung der Exekutivfunktionen mit mangelnder Hemmungskontrolle (Impulsivität), Abneigung gegenüber Belohnungsaufschub, motorische Überaktivität, gestörte Verarbeitung von Reizen hinsichtlich verfügbarer Zeitfenster zur Erledigung von Aufgaben, bei erhöhter inter- und intraindividueller Variabilität der Reaktionszeit und eine dysfunktionale Regulierung der

Anstrengungsbereitschaft in Hinblick auf zielbezogenes Verhalten (Schneider & Margraf, 2009).

2.5.1 Die Conners-3 Fragebögen

Die Conners-3 Fragebögen (Conners 3rd; Conners, 2008) sind das Ergebnis der kontinuierlichen Entwicklung der Conners Rating Scales (CRS) und ihrer Revision (CRS-R; Conners, 1997). Die Ergebnisse der explorativen und konfirmatorischen Faktoranalysen der deutschen Übersetzung (Lidzba et al., 2013) zeigten, dass die ursprüngliche amerikanische Version ohne Modifikationen zum Zweck der klinischen Diagnostik und Evaluation im deutschsprachigen Raum eingesetzt werden kann (Christiansen et al., 2016). Die Conners-3 Fragebögen erfassen ADHS-Symptome und damit assoziiertes Problemverhalten bei Kindern und Jugendlichen zwischen 6 und 18 Jahren (Lidzba et al., 2013). Die Beurteilung basiert auf der Bewertung der Kinder (Selbst-Rating), sowie deren Eltern (Eltern-Rating) und Lehrer (Lehrer-Rating). Die Symptome werden auf einer Likert-Skala von "0" (gar nicht / nie) bis "3" (sehr viel / sehr häufig)gewertet. Die Langform der Selbstbeurteilung besteht aus 94 Items, die nicht nur ADHS Kernsymptome, sondern auch Probleme exekutiver Funktionen, Lernprobleme, Aggressionen und Peer / Familienbeziehungen erfassen. Die Conners-3 Fragebögen umfassen weiterhin Screening-Items für die Erfassung von Angst- und Depressionssymptomen, Skalen, die sich direkt auf die DSM-IV-TR Diagnosekriterien beziehen (sogenannte Symptomskalen), sowie Skalen zur Erfassung der häufigst auftretenden komorbiden Gruppe von Störungen, der Störung des Sozialverhaltens und der oppositionellen Verhaltensstörung. Die Eltern- und Lehrerbewertung unterscheiden sich von den Selbst-Bericht in erster Linie in der Formulierung der Fragen. Die Langform der Parent-Rating-Skalen enthält 105 Items, während die Langform der Lehrer-Rating-Skalen aus 111 Items besteht. Die Conners-3 Skalen zählen zu den weltweit am häufigst genutzten Fragebogenverfahren zur Erfassung von ADHS im Kindesalter (Müller et al., 2011a, 2011b) und wurden mittlerweile in viele Sprachen übersetzt. Der Einfluss von kulturellen Variation auf die Wahrnehmung und Beurteilung von Symptomen und die daraus resultierenden Auswirkungen auf die Rating-Skalen bleibt jedoch weitgehend unklar.

Der erste Artikel dieses Kumulus überprüft die Übertragbarkeit der deutschen Version der Conners-3 Skalen auf eine Stichprobe deutscher Kinder mit türkischem Migrationshintergrund.

2.5.2 Die Conners Adult ADHD Rating Scales (CAARS)

Die Conners' Adult ADHD Rating Scales (CAARS) (Conners et al., 1999) haben sich als zuverlässiges und valides Instrument zur Erfassung von ADHS-Symptomen im Erwachsenenalter erwiesen. Die deutsche Adaption der CAARS (Christiansen et al., 2014) erfasst die ADHS Kernsymptome und damit assoziiertes Problemverhalten bei Erwachsenen ab 18 Jahren. Die Erfassung einzelner Symptome und deren Auftretenshäufigkeit erfolgt über Selbst- und Fremdeinschätzungen. Die Fragen werden auf einer 4-stufigen Likert- Skala (0 = überhaupt nicht, nie; 1 = ein wenig, manchmal; 2 = stark, häufig; 3 = sehr stark, sehr häufig) beantwortet. Die vollständige Version der CAARS (CAARS-S/O: L) besteht aus insgesamt 66 Fragen, die die ADHS Kernsymptomatik (*Unaufmerksamkeit / Gedächtnisprobleme, Hyperaktivität / Ruhelosigkeit und Impulsivität / Emotionale Labilität)* sowie damit assoziierte *„Probleme mit dem Selbst-Konzept“,* erfassen. Des Weiteren wurden zwei Skalen integriert, die sich direkt auf die DSM-IV-TR spezifischen diagnostischen Kriterien beziehen (*DSM-IV Unaufmerksamkeit* und *DSM-IV Hyperaktivität/Impulsivität*). Die Kurzform des Fragebogens (CAARS-S/O: S) besteht aus 26 Fragen und erfasst die ADHS Kernsymptomatik sowie das Selbstkonzept des Befragten, während die Screening-Version, bestehend aus 30 Fragen, den Schwerpunkt auf die Erfassung der DSM-IV-TR spezifischen diagnostischen Kriterien legt. In den Studien, die in dieser kumulativen Dissertation vorgestellt werden, kam ausschließlich die Kurzform der CAARS (26 Items) zum Einsatz. Alle Versionen der CAARS beinhalten zudem die Skala *ADHS-Index*, welche diejenigen 12 Fragen umfasst, die sich laut Handbuch (Conners et al., 1999) am besten zur Diskrimination von Patienten mit ADHS und Kontrollprobanden geeignet haben. Der *„Inkonsistenz-Index“* ermöglicht zudem die Identifikation von zufälligem oder bewusst verzerrendem Antwortverhalten.

Die vier Subskalen der Conners-Skalen (Unaufmerksamkeit, Hyperaktivität, Impulsivität und Probleme mit dem Selbstkonzept) zeigten eine hohe interne Konsistenz, die Alpha-Koeffizienten für beide Gruppen (Kontrollpersonen und Patienten) lagen zwischen 0,74 und 0,95. Die CAARS-Subskalen verfügen über eine diagnostische Sensitivität von 61,2–78,8 % und eine Spezifität von 83,4–88,0 %; die Skalen sind demnach genauer in der korrekten Identifikation von Personen, die kein ADHS haben, identifizieren jedoch erwiesenermaßen auch Patienten mit ADHS-Symptomen. Zudem gibt es bislang wenige Studien, die die Eignung der CAARS-Fragebögen zur Differenzierung zwischen ADHS-Patienten und anderen klinischen Gruppen welche ähnliche Symptome aufweisen, überprüft haben. Dies ist Gegenstand des zweiten Artikels dieses Kumulus.

2.5.3 Der Quantifiedbehavior Test (Qb-Test)

Ein Continuous Performance Test (CPT) bezeichnet jede Art neuropsychologischer Testung, welche die Fähigkeit zur selektiven Aufmerksamkeit (Marker für Ablenkbarkeit) und Daueraufmerksamkeit (Marker für Impulsivität) eines Probanden erfasst. Ein bekannter computerbasierterCPT im deutschsprachigen Raum ist bspw. die Testbatterie zur Aufmerksamkeitsprüfung (TAP bzw. KiTAP für Kinder) (KiTap; Zimmermann, Gondan, & Fimm, 2002). Der Qb-Test kombiniert erstmals das CPT Paradigma mit einer parallelen apparativen Messung der motorischen Aktivität. Ziel ist die objektive Erfassung der drei ADHS Kernsymptome (Hyperaktivität, Unaufmerksamkeit und Impulsivität). Während der Bearbeitung eines CPT werden die Bewegungen des Probanden mittels Infrarot-Kamera erfasst. Je nach Testversion werden zwei bzw. vier unterschiedliche Stimuli (Zielreize und Nicht-Zielreize) auf dem Bildschirm dargeboten. Die Probanden sollen so schnell wie möglich auf den Zielreiz reagieren, bzw. eine Reaktion auf den Nicht-Zielreiz unterlassen. Sowohl Schnelligkeit als auch Genauigkeit des Antwortverhaltens werden berücksichtigt. Der Proband trägt einen Reflektor auf der Stirn, der die Bewegungen mit Hilfe einer Infrarotkamera erfasst (Ulberstad, 2012). Es gibt Versionen für Kinder im Alter von 6-12 Jahren (Qb-Test) und für Jugendliche und Erwachsene im Alter von 12-60 Jahren (Qb-Test plus), wobei der Qb-Test plus länger dauert und etwas komplexer ist. Für beide Testversionen liegen alters- und geschlechtsspezifische Normen vor. Die Auswertung umfasst 17 Parameter, die in 12 CPT Parameter und fünf Aktivitätsparameter unterschieden werden.

Der Qb-Test wird als diagnostisches Verfahren für ADHS vermarktet und teilweise bereits zur Dosierung bzw. Überprüfung der Wirksamkeit von Medikation eingesetzt (Bijlenga, 2015, 2015; Vogt et al., 2011; Wehmeier et al., 2012; Wehmeier et al., 2011). Weiterhin fand er in Studien zu unterschiedlichen Aspekten von ADHS Verwendung (Brocki et al., 2008; Scholtens et al., 2011). Insgesamt stellt die Komponente der apparativen Messung von motorischer Aktivität eine sinnvolle Ergänzung im Vergleich zu herkömmlichen neuropsychologischen Verfahren dar. Die Studie zur Faktorstruktur und zur Validität des Qb-Tests (Reh, Schmidt, Lam, Schimmelmann, Hebebrand, Rief & Christiansen, 2013) gehört zu den ersten Studien hinsichtlich der psychometrischen Eigenschaften des Tests und bildet den dritten Artikel dieser kumulierten Disssertation.

2.6 Verlauf

Ein substantieller Anteil der Kinder mit ADHS wird auch im Erwachsenenalter noch eine relevante Syptomatik aufweisen. Schätzungen diesbezüglich schwanken zwischen einem und zwei Dritteln der betroffenen Kinder (Gentile et al., 2006). Die großen Schwankungen scheinen jedoch auf Unterschiede der Studien und gängigen Diagnosesysteme zu beruhen (Barkley et al., 2002). Auch die teils divergierenden Ansätze bei der Beurteilung von Remission tragen zu den Schwankungen in den Schätzungen bei (Biederman, 2004). Aktuelle epidemiologische Studien schätzen die Lebenszeitprävalenz von ADHS bei Erwachsenen auf 3-5 % (Faraone, 2004; Kessler et al., 2006). Über den Verlauf der Lebensspanne sind die ADHS-typischen Symptome Hyperaktivität, Impulsivität und Unaufmerksamkeit dann insgesamt rückläufig (Biederman et al., 2000). Bei nicht-diagnostizierten, unbehandelten Betroffenen treten im weiteren Lebensverlauf vor allem die Begleit- bzw. Folgeerkrankungen in den Vordergrund und sind oft die Ursache für die Motivation nach medizinischer oder therapeutischer Behandlung.

2.7 Komorbidität

Unter Komorbidität versteht man ein zusätzlich zur bestehenden Erkrankung diagnostisch abgrenzbares Krankheits- oder Störungsbild. Zwei von drei Kindern mit ADHS erfüllen auch die diagnostischen Kriterien mindestens einer weiteren psychischen Störung (Cormier, 2008). Zu den häufigsten komorbiden Diagnosen im Kindesalter zählen Störungen des Sozialverhaltens, Lernstörungen, affektive Störungen, Autismus-Spektrum-Störungen und Angststörungen (Biederman, 2005; Steinhausen et al., 2006). Bei den Störungen des Sozialverhaltens unterscheidet das DSM-5 zwischen der Oppositional Defiant Disorder (ODD; DSM-V: 313.81), bei der sich das betroffene Kind in einem nicht altersentsprechenden Maß aufsässig und provokativ gegenüber Authoritäten verhält, und der Conduct Disorder (CD; DSM-IV: 312.8), bei der das Kind, bzw. der / die Jugendliche gewohnheitsmäßig die Rechte und sozialen Normen des Umfelds missachtet (z. B. Tierquälerei, Diebstahl, körperliche und psychische Gewaltausübung). Dem Störungsbild der ODD entspricht nach ICD-10 die Störung des Sozialverhaltens, mit Beschränkung auf den familiären Rahmen (F91.0), während die Störung des Sozialverhaltens mit oppositionellem, aufsässigem Verhalten (F91.3) der Conduct Disorder nach DSM-V entspricht. Etwa 50% der von ADHS betroffenen Kinder und Jugendlichen erfüllen die Kriterien für die Diagnose einer ODD, immerhin 20% die Kriterien für die Diagnose einer Conduct Disorder (McBurnett, 2009).

Von ADHS betroffene Jugendliche und Erwachsene haben zudem eine erhöhte Anfälligkeit für Substanzmissbrauch, vorwiegend Cannabis und Alkohol betreffend (Kooji et al., 2010). Im Bereich somatischer Beschwerden fanden Instanes et al. (2016) deutliche Zusammenhänge mit Adipositas, Asthma und Schlafstörungen sowie schwächere Zusammenhänge zu Zöliakie und Migräne. In einer Meta-Analyse wurden zudem Zusammenhänge zwischen ADHS und Neurodermitis gefunden (Schmitt, 2013). Befunde zur verminderten Intelligenzleistung von ADHS betroffenen Kindern sind umstritten, da bislang nicht klar ist, ob diese aufgrund mangelnder kognitiver Fähigkeiten oder der Symptomatik (erhöhte Unaufmerksamkeit) zu Stande kommen (Frazer, 2004).

Auch erwachsenen Patienten mit ADHS leiden häufig unter komorbiden Erkrankungen, insbesondere der antisozialen Persönlichkeitsstörung, Borderline-Persönlichkeitsstörung, affektiven Störungen sowie Suchterkrankungen (Krause, 2014; Wender, 1995). Oft verursachen die komorbiden Probleme im Erwachsenenalter einen größeren Leidensdruck für den Patienten und dessen Umfeld, als die eigentliche ADHS-Symptomatik (Kessler et al., 2005). Erwachsene - bislang nicht diagnostizierte - Betroffene suchen zumeist Behandlung aufgrund eines komorbiden Störungsbildes. Zudem ähneln die Symptome einer ADHS denen einiger damit assoziierter komorbider Störungen (bspw. Konzentrationsschwierigkeiten bei Depression oder Impulsivität bei Suchterkrankungen oder der Borderline-PS) was dazu führen kann, dass die zugrundeliegende Störung nicht erkannt wird und nicht adäquat behandelt werden kann. Psychische Störungen, die mit chronischen depressiven Verstimmungen, dauerhaften Stimmungsschwankungen oder impulsivem Verhalten assoziiert sind, bspw. die Borderline-Persönlichkeitsstörung, werden häufig mit ADHS verwechselt (Kooji et al 2010). Auch kann die Abgrenzung zu autistischen Störungen schwierig sein, wenn durch die ADHS entstandene soziale Defizite vorliegen.

2.8 Therapie

Eine leitliniengerechte Behandlung von ADHS im Kindes- und Jugendalter hat die Verringerung der Kernsymptomatik, eine altersadäquate psychosoziale Entwicklung und Integration, die Verbesserung der Eltern-Kind-Beziehung, den Aufbau bzw. Erhalt eines stabilen Selbstwertgefühls, sowie die Gewährleistung einer begabungsentsprechenden Schul- und Berufsausbildung zum Ziel (Arbeitsgemeinschaft ADHS der Kinder- und Jugendärzte e.V., 2014). Da eine kausale Behandlung von ADHS, d. h. eine Modifikation der Gene, die für Neurotransmitteraktivität verantwortlich sind, nicht möglich ist, wird eine symptomatische

Behandlung mittels Psychoedukation, Verhaltenstherapie und medikamentöser Behandlung empfohlen. Begleitend sollten eventuell vorhandene - mit ADHS assoziierte - umschriebene Entwicklungsstörungen, komorbide Störungen und intrafamiliäre Probleme behandelt werden (bspw. über Ergotherapie, Elterntraining, Selbsthilfegruppen). Medikamentöse Therapie ist primär bei einem ausgeprägten Schweregrad der Störung und krisenhafter Zuspitzung indiziert, Verhaltenstherapie bei schwächeren Ausprägungen (Van der Oord et al., 2008). Bei ADHS im Erwachsenenalter sollte bei Bedarf zunächst medikamentös behandelt werden. Bei trotz Medikation weiterbestehender Einschränkungen oder pharmakologischer Nonresponse sollte Verhaltenstherapie im Gruppenkontext erfolgen (Nice Guidelines, 2009).

2.8.1 Medikamentöse Behandlung

In Fällen erheblichen Leidensdrucks des Betroffen und/oder dessen Umfelds ist eine Medikation zur Reduktion hyperkinetischer Symptome und der Verbesserung der Aufmerksamkeits-, Konzentrations- und Selbststeuerungsleistung indiziert. In schweren Fällen wird hierbei überhaupt erst die Voraussetzung für eine psychotherapeutische Behandlung geschaffen (Leitlinie der Arbeitsgemeinschaft ADHS der Kinder- und Jugendärzte e. V., 2014), zudem gilt es als belegt, dass eine Kombinationsbehandlung aus Psychopharmaka und Psychotherapie die Symptomatik am effektivsten und nachhaltigsten verbessert (Langosch, 2015). Laut der Leitlinie der Arbeitsgemeinschaft ADHS der Kinder- und Jugendärzte e.V. (2014) sollten bei der medikamentösen Behandlung von betroffenen Kindern in Deutschland Stimulanzien, primär Methylphenidat (bspw. „Medikinet“, „Ritalin“), zum Einsatz kommen. Bei nicht ausreichender Wirkung oder nicht tolerablen Nebenwirkungen wird eine Umstellung auf Amphetamine (Lisdexamophetamin, D-Amphetamin) oder Atomoxetin („Strattera“), einem selektiven Noradrenalin-Wiederaufnahmehemmer, empfohlen. Etwa 80 % der Betroffenen sprechen auf eine Behandlung mit Methylphenidat oder Amphetaminen an. Die Wirkung aller aufgeführten Medikamente auf die Kernsymptome von ADHSwurde in zahlreichen Studien nachgewiesen (Brown, 2005). Metaanalysen zeigten Effekstärken von 0,8 bis 1 für Methylphenidat(-präperate) und von 0,6 bis 0,7 für Atomoxetin (Banaschewski, 2006). Seit September 2015 ist zudem das Medikament Guanfacin, welches ursprünglich der Behandlung von Bluthochdruck diente, zur Behandlung von Kindern und Jugendlichen mit ADHS zugelassen, wenn eine Behandlung mit Stimulanzien nicht in Frage kommt, nicht vertragen wird oder unwirksam ist.

„Medikinet adult“ und „Strattera“ sind überdies zur Behandlung bei ADHS im Erwachsenenalter zugelassen.

Dennoch spricht ein substantieller Anteil der Betroffenen nicht auf eine medikamentöse Therapie an, zudem werden Nebenwirkungen wie z. B. Schlafstörungen, Kopf- und Bauchschmerzen und Appetitmangel berichtet. Im Anschluss an die Wirkzeit kann zudem ein „rebound“ auftreten, eine ausgeprägte Steigerung der Ausgangssymptomatik. Abschließend ist zu sagen, dass die Familien betroffener Kinder einer medikamentösen Therapie der Symptomatik oft ablehnend gegenüberstehen, weswegen die Entwicklung und Verbesserung nicht-pharmakologischer Behandlungsalternativen wichtig ist.

2.8.2 Psychotherapeutische Behandlung

„Verhaltenstherapie ist eine spezielle Form der Psychotherapie, die sich bei der Behandlung von AD(H)S als besonders wirksam erwiesen hat. Bei dieser Therapie wird angenommen, dass jedes Verhalten erlernt worden ist und deshalb auch wieder "verlernt" werden kann. Eine psychische Störung (wie ADHS) bildet sich demnach unter anderem aus, weil das Kind unangepasste Verhaltensweisen erlernt hat.“ (Lauth&Schlottke, 2009)

Die verhaltenstherapeutische Behandlung von Kindern mit ADHS legt den Schwerpunkt darauf, bereits bestehende funktionale Verhaltensweisen zu verstärken, bei gleichzeitiger Löschung dysfunktionaler Verhaltensweisen. Zudem werden Impulssteuerung, Planverhalten und Selbstreflektion des Kindes trainiert. Weiterhin sind Eltern- und Lehrertrainings unverzichtbarer Bestandteil verhaltenstherapeutischer Programme, diese umfassen Psychoedukation und vermitteln geeignete Hilfen zum Aufbau von verlässlichen Regeln und sicheren Strukturen (z. B. Verstärker- und Punktesysteme). Die Wirksamkeit verhaltenstherapeutischer Verfahren ist in Meta-Analysen belegt worden (Daley et al., 2014; Fabiano et al., 2009).

Die Therapie von Erwachsenen mit ADHS zielt primär auf eine verbesserte Strukturierung des Alltags, den Abbau von Prokrastination und den Erwerb von Strategien zur Emotionsregulation ab. Zusätzlich zu Psychoedukation bzgl. Störung und Medikation sowie Coaching und klassischer verhaltenstherapeutischer Techniken (Verhaltensanalysen), kommen hier auch Elemente der Dialektisch-Behavioralen Therapie „DBT“ (Linehan, 1996), beispielsweise Achtsamkeitsübungen, zum Einsatz. Die Therapie findet überwiegend im Gruppensetting statt (Hesslinger, Philippsen & Richter, 2004).

Beim Neurofeedback (EEG-Biofeedback) werden in Echtzeit analysierte elektroenzephalografische Wellen ermittelt und visualisiert, woraus Rückschlüsse auf den Aufmerksamkeits- und Bewusstseinszustand des Probanden gezogen werden können. Die eigenen Hirnstrommuster werden dem Probanden in Echtzeit zurückgemeldet, was dem Probanden ermöglichen soll eine bessere Selbstregulation anzutrainieren. Die Wirkung wurde bislang in zwei Meta-Analysen bestätigt (Arns et al. 2009; Lofthouse et al., 2012). In einer laufenden Therapiestudie am Fachbereich Psychologie der Philipps Universität Marburg wird derzeit die Anwendbarkeit und Effektivität von Neurofeedback bei Grundschülern in einem ambulanten „natürlichen“ Setting untersucht. Über einen Zeitraum von bis zu einem Jahr nach Therapieende wird das Neurofeedback mit dem verhaltenstherapeutischen Selbstmanagementtraining nach Lauth und Schlottke verglichen (Details zur Studie: Christiansen, Reh, Schmidt & Rief, 2014).

Da sowohl medikamentöse, als auch psychotherapeutische Behandlungsansätze der ADHS ein hohes Maß an Spezifität im Vergleich zu anderen - auch häufig komorbiden - Störungen aufweisen und vor Allem nicht-diagnostizierte, erwachsene Patienten eine Behandlung häufig erst in Folge komorbider Störungen aufsuchen sind die Anforderungen an psychometrsiche Verfahren zur Erfassung vielfältig. Neben Reliabilität, Validität, Ökonomie und einfacher Anwendbarkeit des Instruments, sind eine möglichst hohe Differenzierungsfähigkeit gegenüber ähnlichen psychischen Störungen/Symptomen sowie eine Stabilität gegenüber subjektiven, z. B. durch kulturelle Unterschiede bedingten, Verzerrungen wichtige Ansprüche an ein Verfahren zur Erfassung von ADHS.

3 Zielsetzungen der Dissertation

3.1.1 Zielsetzungen Studie 1

Kulturelle Variation kann sowohl die Reliabilität als auch Validität von Fragebogenverfahren beeinträchtigen. Besonders problematisch ist dies in Hinsicht auf die Diagnostik bei internationalen Multi-Center Studien zur einheitlichen Erfassung psychopathologischer Symptome. Der erste Artikel beschäftigt sich mit dem Einfluß kultureller Variation auf die Erhebung von ADHS-Symptomen mittels der Conners-3 Fragebögen. Ist die deutsche Übersetzung dieses Instruments zur Diagnostik von in Deutschland lebenden Kindern mit türkischem Migrationshintergrund geeignet? Zur Beantwortung diese Frage wird

a) die im Originalfragebogen postulierte Faktorenstruktur an einer Stichprobe von Kindern mit türkischem Migrationshintergrund überprüft.
b) der mögliche Einfluß von elterlicher Akkulturation auf die Beurteilung von ADHS-Symptomen betrachtet.
c) abschließend im Sinne der Validitätsprüfung die Übereinstimmung zwischen Selbstbeurteilungen der Kinder - sowie deren Eltern und Lehrern – analysiert.

3.1.2 Zielsetzungen Studie 2

ADHS, eine Entwicklungsstörung mit Beginn in der Kindheit, persistiert oftmals bis in das Erwachsenenalter hinein. Eine zuverlässige Diagnose wird dann, sowohl durch die Überlappung der Kernsymptomatik (Aufmerksamkeitsprobleme, Hyperaktivität und Impulsivität) mit Symptomen anderer psychischer Störungen, als auch durch die typischerweise hohen Komorbiditätsraten der Störung im Erwachsenenalter, welche die darunter liegende Symptomatik oft überdecken, erschwert. Die Befundlage bezüglich der Diskriminierungsfähigkeit gängiger psychometrischer Testverfahren ist bislang uneinheitlich. Der zweite Artikel dieser Dissertation überprüft deshalb die Eignung der deutschen Version der Conners Adult ADHD Rating Scales (CAARS) zur Differenzierung von Patienten mit ADHS und Patienten mit Diagnosen von Erkrankungen, die mit einem Mangel an Impulskonrolle assoziiert sind sowie einer Kontrollgruppe. Zur Beantwortung diese Frage wird geprüft

a) ob und inwiefern sich die verschiedenen Gruppen (ADHS, pathologisches Kaufverhalten, problematisches Spielverhalten, extreme Adipositas und eine Kontrollgruppe) über die spezifischen Symptome hinweg ähneln.
b) welche Skalen zur bestmöglichen Differenzierung am geeignetsten sind. Auf dieser Grundlage wird dann geschätzt, ob der Proband von ADHS betroffen ist oder nicht (Sensitivität und Spezifitätsparameter).
c) wie präzise die Zuordnung der Probanden auf Basis der Normen und Ausschlusskriterien des Manuals möglich ist.

3.1.3 Zielsetzungen Studie 3

Den Goldstandard bei der Diagnostik von ADHS umfasst die Erfassung und Auswertung von Informationen unterschiedlicher Quellen (Selbst- und Fremdbeurteilung) und Modalitäten (Fragebögen, klinische Interviews, Verhaltensbeobachtung). Weiterhin gelten neuropsychologische Testverfahren, aufgrund ihrer hohen Objektivität, als unverzichtbarer Bestandteil jeder ernstzunehmenden diagnostischen Beurteilung. Gängigen neuropsychologischen Testverfahren fehlt bislang die ausreichende Spezifität zur Differenzierung zwischen ADHS und anderen klinischen Störungsbildern, ggf. auch deswegen, weil die Erfassung von Hyperaktivität, einem Kernsymptom von ADHS, in neuropsychologischen Tests nicht berücksichtigt wird. Aus diesem Grund kombiniert der QB-Test gängige CPT-Maße mit der Bewegungsmessung des Probanden während der Testung. Bislang fehlen jedoch Befunde bezüglich Faktorenstruktur und Validität des Verfahrens. Es ist weiterhin unklar, wie die Qb-Test Variablen miteinander in Verbindung stehen und ob sie tatsächlich ADHS-Symptome erfassen. Um die Frage der spezifischen Eignung des QB-Tests zur Diagnostik von ADHS zu beantworten wird geprüft

a) ob die 17 Einzelvariablen des Qb-Tests auf Faktorebene zusammenfasst werden könnenund die sich ergebenden Faktoren inhaltlich mit den Kernsymptomen der ADHS übereinstimmen.

b) wie hoch die Übereinstimmung des Qb-Tests mit anderen psychometrischen Verfahren zur Erfassung von ADHS Kernsymptomen ist.

c) wie inhaltlich homogen die ermittelten Faktoren (interne Konsistenz), wie hoch die Übereinstimmungen zu ähnlichen Konstrukten (konvergente Validität) und wie niedrig die Übereinstimmungen zu unterschiedlichen Konstrukten (divergente Validität) sind.

3.2.1 Methoden Studie 1

Mittels einer konfirmatorischen Faktorenanalyse (CFA) wurde die Faktorenstruktur einer Stichprobe von in Deutschland lebenden Kindern mit türkischem Migrationshintergrund mit der postulierten Faktorenstruktur der Originalversion der Conners-3 Fragebögen verglichen. Die CFA wurde mit 238 Fragebögen zur Selbsteinschätzung, sowie194 Eltern- und 204 Lehrerfragebögen durchgeführt und ordnet insgesamt 44 Items (42 beim Lehrerfragebogen) vier Symptomskalen zu, wobei Korrelationen zwischen den Faktoren zugelassen wurden. Die Unweighted Least Square (ULS) Methode, welche die geringsten Voraussetzungen an Verteilung und Skalierungseigenschaften der Variablen stellt, wurde verwendet, um den Modellfit zu schätzen. Folgende Indizes wurden zur Beurteilung des Modellfits herangezogen: Root Mean Square Residual (RMR), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Normed-Fit Index (NFI) und Parsimony Normed-Fit Index (PNFI). Anschließend wurden Validitätsanalysen auf Basis des Multi-Trait-Multi-Method (MTMM) Ansatzes durchgeführt, wobei Indikatoren des gleichen Konstrukts, mit unterschiedlichen Methoden erhoben, hoch korrelieren (Monotrait-Heteromethod Korrelation→ konvergente Validität) und unterschiedliche Konstrukte mit unterschiedlichen Methoden erhoben, niedrig korrelieren (Heterotrait-Heteromethod Korrelation → divergente Validität) sollten. Die Korrelation identischer Skalen über verschiedene Rating-Modalitäten (Selbst, Eltern, und Lehrer) hinweg dienten hierbei als Indikatoren konvergenter Validität, die Korrelation unterschiedlicher Skalen über die Rating-Modalitäten als Indikatoren divergenter Validität. Die Einflüsse von Alter, Geschlecht und dem Akkulturationsgrad der Eltern auf die berichtete ADHS-Symptomatik wurde abschließend mit Hilfe einer MANCOVA untersucht.

3.2.2 Methoden Studie 2

Zunächst wurden die Mittelwerte der CAARS-Skalen (Kurzfassung) über alle Gruppen (n=1429) hinweg mittels MANCOVA miteinander verglichen, wobei Alter und Geschlecht als Kovariaten in die Analyse eingingen. Signifikante Unterschiede wurden mit ANOVAS und T-Tests (unter Verwendung der Bonferroni-Korrektur für mehrfacheTestung) weiter ausgewertet. Mittels einer Diskriminanzanalyse wurden anschließend schrittweise die Skalen extrahiert, die sich zur Vorhersage einer ADHS-Diagnose basierend auf den Werten der CAARS-Skalen am besten eigneten. Auf Grundlage dieser Analyse wurden Sensitivitäts- und Spezifitätsparameter berechnet. Basierend auf den Vorgaben des Manuals wurde dann der Inkonsistenz-Index fürjeden der 1429 Datensätze berechnet und anschließend diejenigen

Probanden von der weiteren Auswertung ausgeschlossen, deren Antwortverhalten laut Manual als „zufällig“ oder „bewusst verzerrend“ eingestuft wurde. Für die verbleibenden 1234 Datensätze wurden wiederum Sensitivitäts- und Spezifitätsparameter berechnet, diesmal basierend auf den Werten der deutschen Normstichprobe des CAARS.

3.2.3 Methoden Studie 3

Die Faktorstruktur des Qb-Tests wurde unter Verwendung explorativer Faktorenanalysen (EFA) an einer Stichprobe von 828 Kindern untersucht. Zur Anwendung kamen Hauptachsenanalysen mit obliquen Rotationen. Zunächst wurden die Faktorladungen der einzelnen Variablen berechnet und anschließend die Variablen in eine zweite EFA eingeschlossen, wenn sie sowohl eine Faktorladung > .30 auf mindestens einem der Faktoren als auch eine konzeptuelle Übereinstimmung mit dem entsprechenden Faktor aufwiesen. Die Entscheidung der Anzahl der zu extrahierenden Faktoren basierte auf dem Kriterium des Eigenwerts größer 1 und dem Scree-Plot. Zudem musste jeder extrahierte Faktor außerdem substantielle Ladungen (> .30) von mehr als einer Variable erhalten. Die interne Konsistenz der Faktoren wurde über Cronbachs Alpha berechnet. Mittels MANOVA wurde anschließend der Einfluss von Alter (6-12) und Geschlecht auf die berichteten Faktoren untersucht. Mit einer separaten Stichprobe von 102 Kindern wurde dann auf Basis des MTMM-Ansatzes die konvergente und divergente Validität der Qb-Test-Faktoren überprüft. Hierbei wurden Korrelationen zwischen Qb-Test-Faktoren, einem weiteren neuropsychologischen Aufmerksamkeitstest für Kinder (KiTap; Zimmermann, Gondan, &Fimm, 2002), dem Conners Eltern- und Lehrerurteil und dem Hawik-IQ Gesamtwert berechnet und interpretiert.

4 Zusammenfassung der Studien und Ergebnisse

4.1 Assessment of ADHD symptoms and the Issue of Cultural Variation: AreConners^{3ed} Rating Scales Applicable to Children and Parents With Migration Background?

Schmidt, M., Reh, V., Hirsch, O., Rief, W., & Christiansen, H. (2013). Assessment of ADHD symptoms and the Issue of Cultural Variation: Are Conners^{3ed} Rating Scales Applicable to Children and Parents With Migration Background? *Journal of Attention Disorders.* DOI: 10.1177/1087054713493319 (IF 2.447).

Theoretischer Hintergrund: Die Prävalenz von ADHS bei Kindern in Deutschland beträgt 5.1%, bei Kindern von Familien mit Migrationshintergrund lediglich 3.1% (Schlack et al., 2007). Dies könnte auf kulturelle Unterschiede, beispielsweise im Hilfesuch-Verhalten oder eine erhöhten Toleranz von ADHS-Symptomen zurückzuführen sein oder auch an einer Inkompatibilität der in Deutschland verwendeten und evaluierten diagnostischen Verfahren liegen. Verzerrungen durch Einflüsse kultureller Variation könnten dazu führen, dass diagnostische Algorithmen und Cut-Offs für Menschen mit Migrationshintergrund ungeeignet sind (Canino & Alegría, 2008). Beispielsweise berichten laut Huss et al. (2008) in Deutschland lebende Familien mit Migrationshintergrund weniger ADHS-Diagnosen, jedoch mehr ADHS-Symptome. In diesem Zusammenhang sollte untersucht werden, ob die Conners-3 Fragebögen zur ADHS-Diagnostik bei in Deutschland lebenden Kindern mit türkischem Migrationshintergrund geeignet sind.

Methode: Mit Hilfe einer konfirmatorischen Faktorenanalyse (CFA) wurde zunächst überprüft, ob sich die - in der Originalversion der Conners-3 postulierte - Faktorenstruktur mit den vorliegenden Daten von in Deutschland lebenden Kindern mit türkischem Migrationshintergrund replizieren lassen würde. Conners-3 Selbst-, Eltern- und Lehrerurteile von 243 Kindern, im Alter von 6-16 Jahren (32.5 % Jungen) mit türkischem Migrationshintergrund wurden untersucht. Für Selbst- (n = 238), Eltern- (n = 194) und Lehrerurteile (n = 204) wurde jeweils eine CFA berechnet, wobei Korrelationen zwischen den Faktoren zugelassen wurden, da diese in der Originalversion ebenfalls bedeutsame Korrelationen aufwiesen (Conners, 2008). Die 44 Einzelitems (42 in der Lehrerbeurteilung) wurden den Skalen Unaufmerksamkeit (INA), Hyperaktivität / Impulsivität (H/I), Oppositional Deviant Disorder (ODD) und Conduct Disorder (CD) zugeordnet. Zur

Schätzung des Modell-fits kam die unweighted least squares (ULS) Methode zum Einsatz und die Güte des Modells wurde anhand von fünf Fitindizes bewertet. In einem zweiten Schritt wurden konvergente und divergente Validität der unterschiedlichen Rating-Modalitäten (Selbst, Eltern, Lehrer) mittels MTMM berechnet. Zuletzt wurde eine Messwiederholungs-MANCOVA über die verschiedenen Informationsquellen (Selbst, Eltern, Lehrer) berechnet, wobei Geschlecht, Alter und Akkulturationsniveua der Eltern als Kovariaten in die Analyse einbezogen wurden. Das Akkulturationsniveau der Eltern war zuvor mittels des Acculturation Assessment Scale Index nach Günay & Haag (1990) ermittelt worden.

Ergebnisse: Die vier Faktoren der Conners-3 konnten mittels CFA über alle Bewertungsmodalitäten hinweg bestätigt werden. Selbst- (Fit Indices: RMR = .036; GFI = .944; AGFI = .938; NFI = .911; PNFI = .863), Eltern- (Fit Indices: RMR = .028; GFI = .963; AGFI = .959; NFI = .950; PNFI = .900), und Lehrerurteil (Fit Indices: RMR = .033; GFI = .973; AGFI = .970; NFI = .968; PNFI = .914) zeigten gute Übereinstimmungen mit der postulierten Faktorenstruktur des Originals, wobei die interne Konsistenz im akzeptablen bis guten Bereich (.72 > α < .87) lag. In der MTMM zeigten sich hohe Monotrait-Heteromethod Korrelationen im Bereich Unaufmerksamkeit (.50 > r < .58), mittlere bis hohe im Bereich Hyperaktivität / Impulsivität (.37 > r <.51), mittlere Korrelationen im Bereich ODD (.29 > r <.41) und kleine bis mittlere im Bereich CD (.25 > r < .31). Bis auf eine Ausnahme korrelierten die ADHS Symptom-Skalen H/I und INA über alle Bewertungsmodalitäten hinweg mit sich selbst am höchsten, was ein Hinweis für eine gute konvergente Validität ist. Wie zu erwarten waren die Heterotrait- Monomethod Korrelationen hoch (bis zu r = .78), dies entspricht den hohen Interkorrelationen der Faktoren in der Originalversion der Conners-3. Das Akkulturationsniveau der Eltern hatte keinen bedeutenden Einfluß auf das Selbst-, Eltern- oder Lehrerurteil (Wilks's Lambda = .964, $F(145.000) = 1.36$, $p = .249$, $\eta 2 = .036$). Des Weiteren zeigten sich keine signifikanten Unterschiede in der Beurteilung zwischen den drei Beurteilungsmodalitäten, wenn das Alter der Kinder statistisch kontrolliert wurde.

Diskussion: Die Faktorstruktur der Originalversion der Conners-3 konnte in der von uns untersuchten Stichprobe von in Deutschland lebenden Kindern mit türkischem Migrationshintergrund erfolgreich repliziert werden. Die Analyse der einzelnen Symptomskalen zeigte, dass a) aufgrund von hohen Korrelationen zwischen den Informationsquellen (Selbst-, Eltern-, Lehrerurteil) die konvergente Validität für die Conners-3 Fragebögen gegeben ist, und b) dass die unterschiedlichen Informationsquellen sich nicht maßgeblich in der Einschätzung der Symptomstärke unterscheiden. Weiterhin zeigten sich die

Conners Skalen durch das Ausmaß an Akkulturation der Eltern unbeeinflusst. Die Conners-3 Skalen können demnach zur ADHS Diagnostik von in Deutschland lebenden Kindern mit türkischem Migrationshintergrund eingesetzt werden.

4.2 Adult attention-deficit/hyperactivity disorder and the dilemma of differential diagnosis. Are the CAARS Rating Scales capable of distinguishing between ADHD and other psychiatric conditions displaying similar symptoms?

Schmidt, M., Müller-Reh, V., Müller, A.,Meyer, C., Rumpf, H.-J., Christiansen, H.. Adult attention-deficit/hyperactivity disorder and the dilemma of differential diagnosis. Are the CAARS Rating Scales capable of distinguishing between ADHD and other psychiatric conditions displaying similar symptoms?

Theoretischer Hintergrund: Die Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS) ist eine lebenslang persisitierende Störung, die Aufmerksamkeit, Impulskontrolle und motorische Kontrolle beeinträchtigt. Obwohl zahlreiche Studien zur Diagnostik von ADHS über verschiedene Altersgruppen hinweg existieren, werden Patienten-Gruppen, die ADHS-ähnliche Beeinträchtigungen aufweisen,selten berücksichtigt. Ziel der vorliegenden Studie ist es zu überprüfen, ob die Conners ADHS-Rating-Skalen (CAARS) in der Lage sind, ADHS von anderen Erkrankungen, die mit mangelnder Impulskontrolle assoziiert sind, zuverlässig zu differenzieren.

Methode: Die Selbstbeurteilung (Kurzfassung) der CAARS-Fragebögen von insgesamt 1429 Probanden wurde ausgewertet (ADHD: n = 123, Obesity: n = 135, Pathologisches Kaufen: n = 62, Problem Gambling: n = 517, Healthy Controls: n = 592). Ein Teil der Probanden der ADHS- und Kontrollgruppen wurde im Internet rekrutiert. Zunächst wurden mit Hilfe einer MANCOVA Mittelwertsunterschiede über alle Gruppen und Skalen berechnet, wobei Alter und Geschlecht der Probanden als Kovariaten in die Analyse einbezogen wurden. Anschließend wurde mittels einer Diskriminanzanalyse überprüft, welche Skalen eine bestmögliche Differenzierung zwischen der ADHS-Gruppe und allen anderen Gruppen ermöglichen, sowie Spezifitäts- und Sensitivitätsparameter errechnet. Abschließend wurden anhand der Regeln des CAARS-Manuals diejenigen Probanden aus der Stichprobe entfernt, die ein „inkonsistentes“ Antwortverhalten gezeigt hatten und auf Basis der CAARS-Normtabellen wieder Spezifitäts- und Sensitivitätsparameter berechnet.

Ergebnisse: Patienten mit ADHS erzielten über alle Skalen hinweg signifikant höhere Werte als die Kontrollgruppe oder die anderen Patientengruppen (bis d = 2,06). Die Effektgrößen sind durchgehend hoch, lediglich der Vergleich mit der Gruppe adipöser Patienten auf der Skala *Probleme mit dem Selbst-Konzept* resultiert in einem mittleren Unterschied (d = 0,52). Je älter der Proband, desto weniger Symptome werden über alle Skalen hinweg berichtet; weibliche Probanden erreichen eine stärkere Ausprägung auf der Skala *Probleme mit dem Selbst-Konzept*, unabhängig von ihrer Gruppenmitgliedschaft. Im Rahmen der Diskriminanzanalyse wurde die Skala *Impulsivität/Emotionale Labilität* aufgrund ihres unzureichenden F-Wertes nicht berücksichtigt. Die verbliebenen Skalen wurden unter Berücksichtigung ihres Beitrags zur Diskrimanzfunktion in der folgenden Reihenfolge ausgewertet: *ADHS-Index, Probleme mit dem Selbst-Konzept, Unaufmerksamkeit* und *Hyperaktivität*. Der Eigenwert (.312) und die kanonische Korrelation (4.88) der resultierenden Diskriminanzfunktion ermöglichen eine gute Gruppentrennung zwischen Patienten mit ADHS und den anderen Gruppen, was in guten Prädiktionsraten (Sensitivität 80%, Spezifität 85%) resultiert. Die Vorhersage der Gruppenmitgliedschaft mittels der Skala *ADHS-Index* anhand der Normwerte der deutschen CAARS-Adaption (Christiansen et al., 2014) resultiert in einer Sensitiviät von 89% (nicht beeinflusst durch Berücksichtigung des *Inkonsistenz-Index*) und einer Spezifität von 68% (73% bei Anpassung an den *Inkonsistenz-Index*) wenn der Cut-off bei einer Standadabweichung über dem Mittelwert angelegt wird. Beim Vergleich der Werte der Teilnehmer mit den höchsten 2% der Normgruppe (> 2 SD) steigt die Spezifität auf 84% (87%, wenn angepasst), während die Sensitivität auf 76% sinkt (78% bei Anpassung). **Diskussion:**Es zeigte sich, dass Probanden der Gruppe mit ADHS auf allen fünf Skalen der CAARS deutlich höhere Werte erzielten, als Mitglieder aller anderen Gruppen. Dies deutet darauf hin, dass die CAARS Symptomcluster, welche in hohem Maß mit typischen Problemen von Menschen mit ADHS assoziiert sind, abbildet, nicht nur unspezifische unaufmerksame, hyperaktive und impulsive Verhaltensweisen. Die CAARS Self-Rating-Skala differenziert zudem erfolgreich zwischen ADHS und anderen Störungen, die mit Problemen mit Impulskontrolle assoziiert sind. Vor allem die Skala ADHD-Index, bestehend aus 12 Items, scheint diesbezüglich ein effektives und ökonomisches Werkzeug zu sein.

4.3 Behavioral Assessment of Core ADHD Symptoms using the QbTest

Reh V., **Schmidt M.**, Lam L., Schimmelmann B. G., Hebebrand J., Rief W., & Christiansen, H. (2015). Behavioral Assessment of Core ADHD Symptoms using the QbTest. *Journal of Attention Disorders*.Vol 19, Issue 12, pp. 1034 - 1045

Theoretischer Hintergrund: Eine zuverlässige Diagnostik von ADHS umfasst die Erfassung und Auswertung von Informationen unterschiedlicher Quellen (Selbst- und Fremdbeurteilung) und Modalitäten (Fragebögen, klinische Interviews, Verhaltensbeobachtung). Aufgrund der hohen Subjektivität dieser Einschätzungen sind Verzerrungen sowie der Einfluss von Geschlecht, Ethnie und sozioökonomischem Status auf die erhobenen Daten als problematisch zu bewerten (Bussing et al., 2008; Edwards et al., 2007). Aus diesem Grund gelten neuropsychologische Testverfahren, aufgrund ihrer hohen Objektivität, als unverzichtbarer Bestandteil jeder ernstzunehmenden diagnostischen Beurteilung. Gängigen neuropsychologischen Testverfahren fehlt bislang die ausreichende Spezifität zur Differenzierung zwischen ADHS und anderen klinischen Störungsbildern, ggf. auch deswegen, weil die Erfassung von Hyperaktivität, einem Kernsymptom von ADHS, in neuropsychologischen Tests nicht berücksichtigt wird. Aus diesem Grund kombiniert der QB-Test gängige CPT-Maße mit einer MTS-basierten objektiven Erfassung der motorischen Unruhe zur Erfassung aller drei Kernsymptome der ADHS. Ziel der Studie ist eine Analyse der Faktorenstruktur des Verfahrens. Es ist weiterhin unklar, wie die 17 Qb-Test Variablen miteinander in Verbindung stehen und ob sie tatsächlich ADHS-Symptome erfassen, weswegen konvergente und divergente Validitätsmaße im Vergleich zu Fragebogenmaßen sowie anderen neuropsychologischen Aufmerksamkeitstests erfasst werden sollen.

Methode: Mit den Qb-Test Daten von 828 mit ADHS diagnostizierten Kindern im Alter von 6-11 Jahren (Mittleres Alter: 8.5 Jahre; 71 % Jungen) wurden zunächst explorative Faktorenanalysen mit obliquer Rotation durchgeführt. Eine MANOVA wurde anschließend berechnet, um mögliche Einflüsse von Alter und Geschlecht auf die Faktorwerte zu überprüfen. Eine separate Stichprobe bestehend aus 102 mit ADHS diagnostizierten Kindern im Alter von 6–12 Jahren (Mittleres Alter: 9 Jahre; 78 % Jungen) wurde Validitätsanalysen auf Basis der MTMM Methode unterzogen. Konvergente und divergente Validität des QB-Tests wurde anhand der Korrelationen mit Conners Eltern- und Lehrerfragebögen (Conners, 2008), mit der KiTap (Zimmermann, Gondan, &Fimm, 2002) und dem Gesamt WISC-IV IQ (Petermann & Wechsler, 2011; Sattler, 1992) berechnet.

Ergebnisse: Im Rahmen der explorativen Hauptachsenanalyse wurden auf Grundlage des Eigenwert-Kiteriums (Eigenwerte: Faktor 1 = 5.40; Faktor 2 = 1.59; Faktor 3 = 1.33) und

Scree Tests drei Faktoren extrahiert. Diese erklären zusammen 76 % der Gesamtvarianz des Datensatzes, wobei der erste Faktor 49.13 % der Gesamtvarianz aufklärt. Die den Faktor bildenden fünf Komponenten (Zeit-aktiv, Distanz, Fläche, Mikrobewegungen, Bewegungssimplizität) sind mit motorischer Aktivität assoziiert (Teicher et al., 1996). Der zweite extrahierte Faktor erklärt 14.43 % der Gesamtvarianz und besteht aus drei Komponenten (Auslassfehler, RT, RT Varianz), die sich dem Bereich Unaufmerksamkeit zuordnen lassen (Nichols & Waschbusch, 2004; Uebel et al., 2010). Der dritte Faktor erklärte 12.11 % der Gesamtvarianz und besteht aus drei Komponenten (Impulsfehler, Mehrfachantworten, Zufall), die mit behavioraler Impulsivität in Verbindung stehen (Slaats-Willemse, Swaab-Barneveld, de Sonneville, van der Meulen, & Buitelaar, 2003). In Folge wurden die drei extrahierten Faktoren gemäß der ADHS-Kernsymptome *Hyperaktivität*, *Unaufmerksamkeit* und *Impulsivität* genannt. Die MANOVA ergab für die drei Faktoren einen signifikanten Haupteffekt für Geschlecht (Wilks Lambda = .95; $F(5,814) = 14.45$; $p = .001$; partielles $\eta 2 = .51$) und Alter (Wilks Lambda = .63; $F(15,2248) = 26.93$; $p = .001$; partielles $\eta 2 = .14$). Hinweise für die konvergente Validität des Verfahrens sind a) die signifikante Korrelation zwischen dem Qb-Test Faktor *Hyperaktivität* und dem Lehrerurteil für hyperaktives Verhalten im Conners Fragebogen ($r = .27^{**}$; $p < .01$), b) die negative Korrelation zwischen dem Qb-Test Faktor *Impulsivität* und den Reaktionszeiten der KiTAP ($r = -.42^{*}$; $p < .05$) und c) die negative Korrelation zwischen dem Qb-Test Faktor *Unaufmerksamkeit* und dem IQ-Wert ($r = -.27^{*}$, $p < .05$). Keine signifikanten Zusammenhänge gab es zwischen den Qb-Test Faktoren und dem Conners Elternurteil zu hyperaktivem, unaufmerksamen oder impulsivem Verhalten. Auf die divergente Validität des Verfahrens deuten fehlende Zusammenhänge zwischen den Qb-Test Faktoren *Hyperaktivität* und *Impulsivität* mit dem IQ der Probanden sowie fehlende Zusammenhänge aller Qb-Test Faktoren mit der Skala *Beziehung zu Gleichaltrigen* in der Eltern- und Lehrerbeurteilung der Conners-Fragebögen.

Diskussion: Die drei Faktoren erklären mit 76 % einen substantiellen Anteil der Varianz in den Daten und stimmen konzeptuell mit Studien zu motorischer Unruhe (Halperin et al., 1992; Teicher et al., 1996), Unaufmerksamkeit (Nichols & Waschbusch, 2004), und impulsivem Verhalten (Egeland & Kovalik-Gran, 2010a, 2010b; McGee et al., 2000; Willcutt et al., 2005) überein. Die Ergebnisse zur konvergenten Validität sind jedoch unheinheitlich. Lediglich der Hyperaktivitätsfaktor wies signifikante Korrelationen zum Lehrerurteil hyperaktiven Verhaltens auf, die beiden Faktoren *Unaufmerksamkeit* und *Impulsivität* zeigten wenig Übereinstimmung mit Fragebogenwerten. Positiv zu werten sind die gefundenen

Erkentnisse bezüglich der Konstruktvalidität des QB-Tests, welcher als einziges neuropsychologisches Verfahren die motorische Aktivität des Probanden zu erfassen in der Lage ist und somit bei der Diagnose von ADHS zukünftig eine wichtige Rolle spielen könnte.

5 Diskussion

Ziel dervorliegenden Dissertation ist eine Verbesserung der Diagnostik von ADHS im Kindes- und Erwachsenenalter. Alle Untersuchungen zu psychometrischen Verfahren verwendeten sehr große Stichproben (jeweils mehrere hunderte Probanden), was die Qualität der Arbeit positiv beeinflußt. Zudem gab es innerhalb aller Datensätze keinen substantiellen Anteil fehlender, bzw. systematisch verzerrter Werte, so daß vereinzelt auftretende Missings mit Hilfe einfacher Alghoritmen ersetzt werden konnten.

5.1.1 Diskussion Studie 1

Die an einer Stichprobe von in Deutschland lebenden Kindern mit türkischem Migrationshintergrund überprüfte Faktorenstruktur stimmte mit der in der Originalversion postulierten Struktur überein. Die Übereinstimmung der Faktorenstruktur konnte zudem an einer deutschen Normstichprobe belegt werden (Hasson & Fine, 2012; Lidzba et al., 2013), im Gegensatz zur Vorgängerversion – den Conners Rating Scales (CRS) – die teilweise gravierende Unterschiede zur Faktorenstruktur der Originalversion aufwiesen (Huss et al., 2001; Huss et al., 2002). Die Skalen der Conners-3 scheinen robust gegenüber möglichen Verzerrungen durch kulturelle Variation und somit „culture fair“ zu sein. Die Reliabilität sowie konvergente und divergente Validität der resultierenden Skalen sind angemessen. Effekte durch das Akkulturationsniveau der Eltern sind zwar vorhanden, sie sind aber klein und ihre Auswirkungen auf die Ergebnisse nicht bedeutsam, somit ist keine Anpassung der Conners-3 Skalen für diese Subgruppe erforderlich. Insgesamt sprechen die Ergebnisse dafür, dass die Conners-3 Skalen auch für in Deutschland lebende Kinder mit türkischem Migrationshintergrund zur ADHS Diagnostik eingesetzt werden können. Die gute faktorielle Validität der Conners-3 Skalen ist zudem auch für die Forschung im Bereich ADHS relevant, beispielsweise in Hinblick auf internationale Studien, bei denen valide, reliable Messverfahren mit kulturunabhängiger Faktorstruktur eine zentrale Bedeutung haben.

5.1.2 Diskussion Studie 2

Die Kurzfassung der CAARS-Fragebögen differenziert angemessen gut zwischen Patienten mit ADHS oder anderen Störungen, die mit mangelnder Impulskontrolle assoziiert sind. Über alle Skalen und Gruppen hinweg sind die Mittelwertsunterschiede konstant hoch.

Sensitivitäts- und Spezifitätsparameter sind angemessen, unabhängig davon, ob die Klassifizierung der Gruppenzugehörigkeit auf Basis der Diskriminanzanalyse oder der Normtabellen der deutschen Version des CAARS-Manuals erfolgt. Besonders die Skala *ADHS-Index*, die aus zwölf Items besteht und bei der Verwendung aller drei CAARS-Versionen (Langform-, Kurzform- oder Screening-Version) berechnet werden kann, hat eine starke Vorhersagekraft. Die Genauigkeit der Vorhersage - nur auf Basis dieser Skala - ist am höchsten (82,5%), wenn als Cut-off ein Wert zwei Standardabweichungen über dem Mittelwert gewählt wird (98. Perzentil). Die Heterogenität der Items, die die Vielfalt der ADHS-Kernsymptomatik abbilden, scheint die Stärke des *ADHD-Index* zu sein, da sie auch bei Überlappung mit vereinzelten Symptomen anderer psychiatrischer Störungen insgesamt robust gegenüber Verzerrungen bleibt. Dies ist relevant, da VanVorhees et al. (2011) Probleme bei der Differenzierungsfähigkeit der CAARS im Bereich Angststörungen und affektive Störungen feststellten. Der deutlichste Unterschied zwischen der Gruppe mit ADHS und allen anderen Gruppen wurde für die Skala *Unaufmerksamkeit / Gedächtnisprobleme* beobachtet. Dies war zu erwarten, da Unaufmerksamkeit bzw. eine schlechte Konzentrationsleistung nicht zur Kernproblematik der anderen untersuchten Gruppen gehört. Die Unterschiede zwischen der Gruppe mit ADHS und allen anderen Gruppen auf den Skalen *Hyperaktivität / motorische Unruhe* und *Impulsivität / Emotionale Labilität* sind etwas niedriger, aber immer noch stark. Auffällig ist, dass weder die Gruppen von Patienten mit pathologischem Kaufverhalten oder Adipositas signifikante Unterschiede auf der Skala *Impulsivität / Emotionale Labilität* im Vergleich zur Kontrollgruppe zeigen, obwohl beide Störungen mit einem Mangel an Impulskontrolle assoziiert sind (Gerlach et al., 2015, Georgiadiu et al., 2014, Mobbs et al., 2010, Müller et al., 2009, Nederkoorn et al., 2006, Stice, 2002, Bonato et al., 1983). Der aktuelle Forschungsstand zeigt, dass der pathologische Kauf als Verhaltenssucht betrachtet werden kann (Müller et al., 2015). Ein Blick auf die Items, welche die Skala *Impulsivität/emotionale Labilität* bilden, macht deutlich, dass sich diese vor allem auf ungestüme und unangemessene Ausdrucksformen emotionaler Zustände (z. B. Probleme mit Wutausbrüchen) beziehen. Der Unterschied in der Impulsivität zwischen Patienten mit ADHS und Patienten mit Verhaltensabhängigkeiten könnte aus unterschiedlichen Strategien zur Emotionsregulation resultieren. Patienten mit Abhängigkeitserkrankungen neigen dazu, aggressive Emotionen durch Verwendung einer Substanz oder eines Verhaltens zu dämpfen, das unangemessene Ausbrüche aversiver emotionaler Zustände weniger wahrscheinlich macht. Die Ergebnisse sprechen dafür, dass mit den *Conners Adult ADHD Rating Scales* – vor allem der Subskala *ADHS-Index* – ein

ökonomisches, valides und reliables Messinstrument zur Erfassung von ADHS im Erwachsenenalter vorliegt.

5.1.3 Diskussion Studie 3

Die drei extrahierten QbTest-Faktoren (*Hyperaktivität*, *Unaufmerksamkeit* und *Impulsivität*), erklärten einen großen Teil der Datenvarianz, zeigten eine gute inhaltliche Übereinstimmung mit den Kernsymptomen der ADHS sowie zufriedenstellende psychometrische Eigenschaften. Die interne Konsistenzder Faktoren *Hyperaktivität* und *Unaufmerksamkeit*war gut und für den Faktor *Impulsivität* akzeptabel. Es zeigten sich Hinweise auf die konvergente und divergente Validität der drei Faktoren. Andererseits gab es keine bedeutsamen Übereinstimmungen der drei QbTest-Faktoren mit den Elternurteilen der Conners-Fragebögen. Allerdings sind geringe Übereinstimmungen zwischen Fragebogenmaßen und computerbasierten, neuropsychologischen Tests zur Erfassung von ADHS-Symptomen keine Seltenheit (DuPaul, 1991; Edwards et al., 2007; Nichols & Waschbusch, 2004). Möglich ist, dass dies auf eine grundsätzlich mangelhafte ökologische Validität von Labormaßen zurückgeführt werden kann (Barkley, 1991). Es ist aber auch denkbar, dass unterschiedliche Methoden auch unterschiedliche Aspekte pathologischen Verhaltens erfassen (Edwards et al., 2007). Fragebögen geben ggf. eher Auskunft über das (auch interaktionelle) Verhalten innerhalb eines längeren Zeitraum und verschiedene Alltagssituationen, während neuropsychologische Testverfahren Verhalten isoliert vom jeweiligen Kontext in einem Laborsetting erfassen und somit ggf. strukturelle Defizite besser erfassen können. Da der Faktor Hyperaktivität als einziger bedeutsam mit einem Fragebogenmaß zusammenhing und mit etwa 49 % auch den größten Anteil an Varianz aufklärte, könnte sich der QbTest insbesondere zur Diagnostik von Kindern mit ADHS des vorwiegend hyperaktiv/impulsiven bzw. des kombiniert unaufmerksam-hyperaktiv/impulsiven Subtyps eignen. Eventuell eignet er sich weniger zur Diagnostik des vorwiegend unaufmerksamen Subtyps, was in nachfolgenden Untersuchungen berücksichtigt werden müsste. Für die Anwendung des Qb-Tests zur Diagnose von ADHS im Kindesalter spricht die separate Erfassung der motorischen Aktivität des Probanden während der Bearbeitung eines klassischen CPTs, die ermittelten drei Faktoren, welche konzeptuelle Übereinstimmungen mit der ADHS-Kernsymptomatik aufweisen sowie die ersten Hinweise auf konvergente und divergente Validität. Der Qb-Test scheint zur separaten und objektiven Erfassung der drei Kernsymptome von ADHS grundsätzlich geeignet zu sein.

5.2 Einschränkungen der Arbeit

Die Geschlechterverteilungen über alle drei Studien hinweg waren unausgewogen und somit nicht geschlechtshomogen. Der Einfluss dieser Ungleichverteilung wurde jedoch in den Analysen aller Studien berücksichtigt.

5.2.1 EinschränkungenStudie 1

Zu den Einschränkungen der ersten Studie gehört das Fehlen einer Kontrollstichprobe bestehend aus in Deutschland lebenden Kindern ohne Migrationshintergrund. Auf Item-Ebene hätte der Vergleich mit einer Kontrollgruppe eine Prüfung der Äquivalenz der faktoriellen Struktur mittels konfirmatorischer Faktorenanalyse ermöglicht. Auf Skalen-Ebene hätten etwaige Unterschiede zwischen den Elternbeurteilungen analysiert und mögliche Einflüsse kultureller Variaton präziser identifiziert werden können. Lehrer sind in ihrer Einschätzung zwar unabhängig vom Akkulturationsniveau der Eltern und können somit begrenzt als Kontrollinstanz fungieren, die Korrelationen zwischen Eltern- und Lehrerurteil sind allerdings niedrig bis allenfalls mittelgroß (Efstratopoulou et al., 2012; Lavigne et al., 2012; Salbach-Andrae et al., 2009; Sims & Lonigan, 2012). Zukünftige Studien zu kulturspezifischen Aspekten sollten deshalb auch Eltern und Kinder ohne Migrationshintergrund einbeziehen.

5.2.2 Einschränkungen Studie 2

Die Teilnehmer der Online-Stichprobe wurden nicht von Klinikern diagnostiziert, sondern der Gruppe mit ADHS bzw. Kontrollgruppe auf Basis ihrer Antwort auf die Frage, ob es jemals in ihrer Vorgeschichte eine ADHS-Diagnose gegeben habe, zugeteilt. Eine weitere Einschränkung ist, dass mögliche Komorbiditäten der Gruppe mit ADHS nicht berücksichtigt wurden und sich auch adipöse Patienten, pathologische Käufer oder Glücksspieler unter den Mitgliedern dieser Gruppe befunden haben könnten, da Patienten mit ADHS häufig von mindestens einer anderen Störung betroffen sind (Kessler et al., 2006, Kooij et al., 2010, Sobanski et al., 2006).

Ebenso war eine ADHS-Diagnose kein Ausschlusskriterium für mit extremer Adipositas oder pathologischen Kauf-/Glücksspielverhalten diagnostizierte Patienten. Diese Gruppen wurden nicht spezifisch auf das Vorliegen einer ADHS untersucht. Die bedeutendste Einschränkung besteht in der Abwesenheit einer Vergleichsgruppe mit diagnostizierter emotional instabiler Persönlichkeitsstörung (impulsiver oder Borderline-Typ), da diese über die mangelnde

Impulskontrolle hinaus zusätzliche gemeinsame klinische Merkmale mit Patienten mit ADHS aufweisen (z. B. emotionale Dysregulation und kognitive Beeinträchtigung) und somit die am schwersten zu unterscheidende Gruppe von Patienten bildet (Philippsen, 2006).

5.2.3 Einschränkungen Studie 3

Bei der faktoranalytisch untersuchten Stichprobe handelte es sich um Kinder, die zwecks ADHS-Abklärung an eine niedergelassene Kinder- und Jugendpsychiatrische Praxis überwiesen worden waren, weswegen eine große Variation im Schweregrad der Störung vorlag. Weiterhin konnte nicht der gesamte Altersbereich des Qb-Tests (6-12 Jahre) abgebildet weden, da Kinder im Alter von 12 Jahren nicht in der Stichprobe repräsentiert waren, zudem fehlten Angaben zu möglichen komorbiden Erkrankungen. Sowohl der Schweregrad der Störung, als auch mögliche Komorbiditäten sollten in künftigen Studien erfasst werden.

5.3 Ausblick

Die klinische Relevanz psychometrischer Verfahren zur Diagnostik von ADHS ist – vor allem im Erwachsenenalter – aufgrund hoher Komorbiditätsraten und starker Überlappungen mit den Symptomen anderer psychiatrischer Erkrankungen stark abhängig von deren Differenzierungsfähigkeit. Im Kindesalter sind beispielsweise das Asperger-Syndrom, im Erwachsenenalter dann die chronisch affektiven Störungen (Dysthmie und Zyklothemie) und die emotional-instabile Persönlichkeitsstörung schwer von einer ADHS abzugrenzen. Weiterhin könnte über, zur Emotionsregulation eingesetzten, Substanzmittelkonsum oder Verhaltenssucht gegebenenfalls ansonsten auffälliges Verhalten „abgeschwächt“ werden und in den Hintergrund treten. Im Erwachsenenalter sind, bei bis dahin nicht diagnostizierteer ADHS, zudem häufig die komorbiden Störungen der Grund medzinische und/oder psychotherapeutische Hilfe in Anspruch zu nehmen. In diesen Fällen ist die Identifikation der zugrunde liegenden ADHS für den Behandlungserfolg äußerst relevant, da sie zum Einen die Optimierung der Medikation des Patienten, mit den dafür vorgesehenen Präperaten, zum Andereneine auf den Patienten angepasste Therapie, mit Schwerpunkt auf Vermittlung von Strategien zur Emotionsregulation und einer verbesserten Strukturierung alltäglicher Abläufe, ermöglicht. Besonders bei Patienten, die zu Stimulanzienmissbrauch / -abhängigkeit neigen, ist zu klären, inwiefern diese der Selbstmedikation dient und ob hier, nach Abwägung aller

Risiken, eine Behandlung mit Methylphenidat sinnvoll sein könnte. Sollte dies im vorliegenden Fall keine Option darstellen, ist dann zumindest eine Intensivierung der psychotherapeutischen Maßnahmen im Bereich Emotionsregulation (bspw. mittels achtsamkeitsbasierter Verfahren) notwendig. Die Skala *ADHS-Index* der CAARS-Fragebögen, der aus lediglich 12 Items besteht, kann hier eine effiziente und ökonomische erste Einschätzung liefern.

Die zuverlässige Diagnose einer ADHS ist zudem nicht nur wegen der zahlreichen Überlappungen mit anderen psychischenStörungen und/oder Komorbiditäten problematisch, sondern auch wegen der mangelnden Spezifität der Symptome. Viele Umstände, die überhaupt nicht mit einer psychischen Erkrankung zusammenhängen müssen, können einen Menschen ruhelos, nervös oder ablenkbar machen, bspw. Trennungen, Schul-/Arbeitsprobleme oder finanzielle Sorgen. Spontane emotionale Reaktionen und „lebendige“ Interaktion sind in einigen Kulturkreisen gängig, in anderen wiederum ungewöhnlich. Manche Kulturkreise legen Wert auf implizite Kommunikation unterstützt durch non-verbale Hinweise, andere wiederum bevorzugen eher explizite Kommunikation (Moran, Abramson, Moran, 2014). Auch bezüglich der Anwendung verbaler oder physischer Aggressionen im Alltag gibt es kulturelle Unterschiede was bspw. Ramirez et al. (2001) in einem Vergleich zwischen spanischen und japanischen Probanden belegen konnten. In den letzten Jahren hat die Beschäftigung mit ethnischen und sozioökonomischen Aspekten der ADHS im Rahmen der Epidemiologie zugenommen. In den USA scheint die Störung am häufigsten unter der afroamerikanischen und am seltensten unter der hispanischen Bevölkerung aufzutreten, es ist allerdings unklar inwiefern der sozioökonomische Status oder Unterschiede in Diagnostik und/oder Behandlung diese Zahlen beeinflußen (Scudder et al., 2015). Eine angemessene Diagnose erfordert außerdem eine Berücksichtigung der individuellen Entwicklung des Kindes, und der jeweiligen pädagogischen Anforderungen und Erwartungen des Umfelds, die wiederum über Kulturen hinweg stark unterschiedlich ausfallen können. Auch langfristig wird eine stetige Verbesserung und Modifikation der bestehenden Verfahren notwendig sein, damit sich weiterhin möglichst objektive, valide und reliable Verfahren als diagnostische Standards etablieren können.

Literaturverzeichnis

Albrecht, B., Brandeis, D., Uebel, H., Heinrich, H., Mueller, U. C., Hasselhorn, M., et al. (2008). Action Monitoring in Boys With Attention-Deficit/Hyperactivity Disorder, Their Nonaffected Siblings, and Normal Control Subjects: Evidence for an Endophenotype. *Biological Psychiatry, 64*(7), 615-625.

American Academy of Child and Adolescent Psychiatry.(2007). Practice Parameter for the Assessment and Treatment of Children and Adolescents with Attention - Deficit / Hyperactivity Disorder.*Journal of the American Academy of Child and Adolescent Psychiatry, 46*(7), 894-921.

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders (4th ed., rev.). DOI:10.1176/appi.books.9780890423349.*

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). doi:10.1176/appi.books.9780890425596.744053

Andreou, P., Neale, B. M., Chen, W. A. I., Christiansen, H., Gabriels, I., Heise, A., Meidad, S., Muller, U. C., Uebel, H., Banaschewski, T., Manor, I., Oades, R., Roeyers, H., Rothenberger, A., Sham, P. A. K., Steinhausen, H.-C., Asherson, P., Kuntsi, J. (2007) Reaction time performance in ADHD: improvement under fast-incentive condition and familial effects. Psychological Medicine 37:1703-1715

Arns, M., de Ridder, S., Strehl, U., Breteler, M., &Coenen, A. (2009). Efficacy of neurofeedback treatment in ADHD: the effects on inattention, impulsivity and hyperactivity: a meta-analysis. *Clin EEG Neurosci, 40*(3), 180-189.

Asherson, P.,Chen, W.,Craddock, B.,Taylor, E. (2006).Adult attention-deficit hyperactivity disorder: recognition and treatment in general adult psychiatry. *The British Journal of Psychiatry,190*(1) 4-5; DOI:10.1192/bjp.bp.106.026484

Banaschewski, T., Coghill, D., Santosh, P., Zuddas, A., Asherson, P., Buitelaar, J., Danckaerts, M., Döpfner, M., Faraone, S.V., Rothenberger, A., Sergeant, J., Steinhausen, H.-Ch., Sonuga-Barke, E.J.S., Taylor, E. (2006). Long-acting medications for the hyperkinetic disorders.A systematic review and European treatment guideline. *Eur Child Adolesc Psychiatry*

Barkley, R. A., Fischer, M., Smallish, L., & Fletcher, K. (2002).The persistence of attention-deficit/hyperactivity disorder into young adulthood as a function of reporting source and definition of disorder.*Journal of Abnormal Psychology, 111*(2), 279-289.

Biederman, J. (2004). Impact of comorbidity in adults with attention deficit/hyperactivity disorder.*Journal of Clinical Psychiatry, 65*(Suppl3), 3-7.

Biederman, J., Mick, E., Faraone, S. V. (2000). Age-dependent decline of symptoms of attention deficit hyperactivity disorder: impact of remission definition and symptom type. *American journal of psychiatry, 157(5), 816-818.*

Literaturverzeichnis

Bijlenga, D., Jasperse, M., Gehlhaar, S. K., Kooij J.J.(2015) Objective QbTest and subjective evaluation of stimulant treatment in adult attention deficit-hyperactivity disorder.*EurPsychiatry. Jan 30(1):179-85*.doi: 10.1016/j.eurpsy.2014.06.003.

Brown, R. T., Amler, R. W., Freeman, W. S., Perrin, J. M., Stein, M. T., Feldman, H. M. (2005). Treatment of Attention-Deficit/Hyperactivity Disorder: Overview of the Evidence. *Pediatrics, 115*(6), e749-757.

Bussing, R., Fernandez, M., Harwood, M., Wei, H., Garvan, C. W., Eyberg, S. M. (2008). Parent and Teacher SNAP-IV Ratings of Attention Deficit Hyperactivity Disorder Symptoms.*Assessment, 15*(3), 317-328.

Bonato, D. P., Boland, F. J. (1983). Delay of gratification in obese children. *Addictive Behaviors* 8 (1), pp. 71–74. DOI: 10.1016/0306-4603(83)90059-X.

Brocki, K. C., Tillman, C. M., &Bohlin, G. (2008).CPT performance, motor activity, and continuous relations to ADHD symptom domains: A developmental study. *European Journal of Developmental Psychology, 7*(2), 178-197.

Canino, G., Alegría, M. (2008). Psychiatric diagnosis — Is it universal or relative to culture? *Journal of Child Psychology and Psychiatry, 49*, 237-250.

Christiansen, H., Hirsch, O., Drechsler, R., Wanderer, S., Knospe, E.-L., Günther, T., &Lidzba, K. (2016).German validation of the Conners 3® rating scales for parents, teachers and children. *Zeitschrift für Kinder- und Jugendpsychiatrie und Psychotherapie,44*, 139-147. DOI: 10.1024/1422-4917/a000408.

Christiansen, H., Reh, V., Schmidt, M., &, Rief, W. (2014). Slow cortical potential Neurofeedback and self-management training in outpatient care for children with ADHD: study protocol and first preliminary results of a randomized controlled trial. *Frontiers in Human Neuroscience*, doi: 10.3389/fnhum.2014.00943

Conners, C. K., Erhardt, D., Sparrow, E. (1999). *Conner's adult ADHD rating scales (CAARS) technical manual.* Multi-Health System.

Conners CK (2008) Conners 3rd edition manual. Multi-Health Systems, Toronto, Ontario, Canada

Cormier, E. (2008). Attention Deficit/Hyperactivity Disorder: A Review and Update. *Journal of Pediatric Nursing, 23*(5), 345-357.

Daley, D., van der Oord, S., Ferrin, M., Danckaerts, M., Doepfner, M., Cortese, S., Sonuga-Barke, E. J. S. (2014). Behavioral Interventions in Attention-Deficit/Hyperactivity Disorder: A Meta-Analysis of Randomized Controlled Trials Across Multiple Outcome Domains, *Journal of the American Academy of Child & Adolescent Psychiatry*, 53(8), 835-84.

Dilling, H., Mombour, W., & Schmidt, M. H. (2009). *Internationale Klassifikation psychischer Störungen. ICD-10 Kapitel V (F). Klinisch-diagnostische Leitlinien* (Vol. 7). Göttingen: Hans Huber.

Doyle, A. E., Willcutt, E. G., Seidman, L. J., Biederman, J., Chouinard, V.-A., Silva, J. (2005). Attention-Deficit/Hyperactivity Disorder Endophenotypes. *Biological Psychiatry, 57*(11), 1324-1335.

Literaturverzeichnis

Döpfner, M., & Metternich, T. W. (2006).*Hyperkinetische Störungen und oppositionelle Verhaltensstörungen. In: Lehrbuch der Psychotherapie - Verhaltenstherapie mit Kindern, Jugendlichen und deren Familien. (Hrsg.: Mattejat, F.)*. München: CIP Medien.

Drechsler, R., Brandeis, D., Földényi, M., Imhof, K., & Steinhausen, H.-C. (2005). The course of neuropsychological functions in children with attention deficit hyperactivity disorder from late childhood to early adolescence. *Journal of Child Psychology and Psychiatry, 46*(8), 824-836.

DuPaul, G. J. (1991). Parent and Teacher Ratings of ADHD Symptoms: Psychometric Properties in a Community-Based Sample. *Journal of Clinical Child Psychology, 20*(3), 245-253.

Edwards, M., Gardner, E., Chelonis, J., Schulz, E., Flake, R., & Diaz, P. (2007).Estimates of the Validity and Utility of the Conners' Continuous Performance Test in the Assessment of Inattentive and/or Hyperactive-Impulsive Behaviors in Children.*Journal of Abnormal Child Psychology, 35*(3), 393-404.

Efstratopoulou, M., Janssen, R., & Simons, J. (2012). Agreement among physical educators, teachers and parents on children's behaviors: A multitrait multimethod design approach. *Research in Developmental Disabilities, 33*(5), 1343-1351.

Egeland, J., &Kovalik-Gran, I. (2010a). Validity of the Factor Structure of Conners'™ CPT. *Journal of Attention Disorders, 13*(4), 347-357.

Egeland, J., &Kovalik-Gran, I. (2010b).Measuring Several Aspects of Attention in One Test. *Journal of Attention Disorders, 13*(4), 339-346.

Epstein, J. N., Erkanli, A., Conners, C. K., Klaric, J., Costello, J. E., &Angold, A. (2003). Relations Between Continuous Performance Test Performance Measures and ADHD Behaviors. *Journal of Abnormal Child Psychology, 31*(5), 543-554.

Fabiano, G. A., Chacko, A., Pelham Jr., W. E., Robb, J., Walker, K. S., Wymbs, F. (2009). A Comparison of Behavioral Parent Training Programs for Fathers of Children With Attention-Deficit/Hyperactivity Disorder. *Behavior Therapy, 40*(2), 190-204.

Faraone, S. V. (2004). Etiology and pathophysiology of adult attention-deficit/hyperactivity disorder.*Primary Psychiatry, 11*(7), 28-34.

Faraone, S. V., Biederman, J. (2005). What Is the Prevalence of Adult ADHD? Results of a Population Screen of 966 Adults.*Journal of Attention Disorders, 9*(2), 384-391.

Faraone, S. V., Perlis, R. H., Doyle A. E., Smoller J. W., Goralnick J. J., Holmgren M. A., Sklar P. (2005) Molecular Genetics of Attention-Deficit/Hyperactivity Disorder. Biological Psychiatry 57:1313-1323

Faraone, S. V., Sergeant, J., Gillberg, C., &Biederman, J. (2003). The worldwide prevalence of ADHD: is it an American condition? *World Psychiatry, 2(2)*, 104-113.

Federal Office for Migration and Refugees Federal Ministry of the Interior.(2013). Migrationsbericht [Migration report].from http://www.bamf.de/SharedDocs/Anlagen/DE/Publikationen/Migrationsberichte/

Frazier, T. W., Demaree, H. A.,Youngstrom, E. A. (2004). "Meta-analysis of intellectual and neuropsychological test performance in attention-deficit/hyperactivity disorder."*Neuropsychology.**18** (3): 543–55. doi:10.1037/0894-4105.18.3.543. PMID 15291732.*

Gentile, J. P., Atiq, R., &Gillig, P. M. (2006). Adult ADHD: Diagnosis, Differential Diagnosis, and Medication Management. *Psychiatry (Edgmont)*, *3*(8), 25–30.

Georgiadou, E., Gruner-Labitzke, K., Köhler, H., de Zwaan, M., Müller, A. (2014). Cognitive function and food-unspecific impulsivity in post bariatric surgery patients.*Frontiers in Psychology, 5, 1502.*

Gerlach, G., Herpertz, S., Löber, S. (2015).Personality traits and obesity: a systematic review.*Obesity Reviews, 16(1), 32-63.*

Günay, E., & Haag, A. (1990). Krankheit in der Emigration. Eine Studie an türkischen Patientinnen in der Allgemeinpraxis aus psychosomatischer Sicht. (Vol. 40). Stuttgart, Germany: Thieme.

Halperin, J. M., Matier K., Bedi G., Sharma V., Newcorn J. H. (1992) Specificity of Inattention, Impulsivity, and Hyperactivity to the Diagnosis of Attention-deficit Hyperactivity Disorder. *Journal of the American Academy of Child & Adolescent Psychiatry* 31:190-196

Hasson, R., & Fine, J. G. (2012). Gender Differences Among Children With ADHD on Continuous Performance Tests. *Journal of Attention Disorders*, *16*(3), 190-198.

Hesslinger, B., Philipsen, A. &Richter, H. (2004) *Psychotherapie der ADHS im Erwachsenenalter*. Göttingen: Hogrefe

Hoffman, H. (2010). *Struwwelpeter: Pretty Stories and Funny Pictures.* London: Pavilion Children´s Books.

Huss, M., Hälling, H., Kurth, B.-M., & Schlack, R. (2008). How often are German children and adolescents diagnosed with ADHD? Prevalence based on the judgment of health care professionals: results of the German health and examination survey (KiGGS). *European Child & Adolescent Psychiatry*, *17*(1), 52-58.

Huss, M., Iseler, A., &Lehmkuhl, U. (2001). Interkultureller Vergleich der Conners-Skalen: Lässt sich die US-amerikanische Faktorenstruktur an einer deutschen Klinikstichprobe replizieren? [Cross-cultural comparison of the Conners scales. Is it possible to replicate the original factor structure on a German clinical sample?]. *Zeitschrift für Kinder Jugendpsychiaterie und Psychotherapie*, *29*(1), 16–24.

Huss, M., Stadler, C., Salbach, H., Mayer, P., Ahle, M., &Lehmkuhl, U. (2002). ADHS im Lehrerurteil: Ein Vergleich von Klinik- und Normstichprobe anhand der Conners-Skalen. [ADHD and teacher rating: Comparison of clinical and normative sample based on Conners rating scales]. Kindheit und Entwicklung, 11(2), 90-97.

Instanes, J. T., Klungsøyr, K., Halmøy, A., Fasmer, O. B., Haavik, J. (2016). "Adult ADHD and Comorbid Somatic Disease: A Systematic Literature Review." *Journal of Attention Disorders*. *doi*:*10.1177/1087054716669589*.

Kessler, R. C., Adler, L., Ames, M., Barkley, R. A., Birnbaum, H., Greenberg, P. (2005).The Prevalence and Effects of Adult Attention Deficit/Hyperactivity Disorder on Work Performance in a Nationally Representative Sample of Workers. *Journal of Occupational and Environmental Medicine, 47*(6), 565-572.

Kessler, R. C., Adler, L., Barkley, R., Biederman, J., Conners, C. K., Demler, O. (2006). The Prevalence and Correlates of Adult ADHD in the United States: Results From the National Comorbidity Survey Replication. *Am J Psychiatry, 163*, 716-723.

Kiss, A., &Kreienbrink, A. (2010). Fortschritte der Integration [Advancements of integration].*Retrieved from http://www.bamf.de/SharedDocs/Anlagen/DE/Publikationen/Forschungsberichte/fb08-fortschritte-der-integration.pdf?__blob=publicationFile*.

Kooij, S. J. J., Bejerot, S., Blackwell, A., Caci, H., Casas-Brugué, M., Carpentier, P. J. (2010). European consensus statement on diagnosis and treatment of adult ADHD: The European Network Adult ADHD. *BMC Psychiatry*10 (1), p. 67. DOI: 10.1186/1471-244X-10-67.

Krause, J., Krause, K.-H. (2014) *ADHS im Erwachsenenalter. Symptome – Differenzialdiagnose – Therapie*. 4. vollst. akt. und erw. Auflage. Schattauer, Stuttgart

Kuntsi, J., Neale, B., Chen, W., Faraone, S., &Asherson, P. (2006). The IMAGE project: methodological issues for the molecular genetic analysis of ADHD. *Behavioral and Brain Functions, 2*(1), 27.

Lange, K. W., Reichl, S., Lange, K. M., Tucha, L., &Tucha, O. (2010).The history of attention deficit hyperactivity disorder.*Attention Deficit and Hyperactivity Disorders*, *2*(4), 241–255. http://doi.org/10.1007/s12402-010-0045-8

Langosch, N. (2015). *Schaden Psychopharmaka Kindern und Jugendlichen? (2015)*Spektrum.de, 9. Oktober 2015, abgerufen am 16. Oktober 2015.

Linehan, M. (1996). *Dialektisch-Behaviorale Therapie der Borderline-Persönlichkeitsstörung.* CIP-Medien.

Lauth, G. W., &Schlottke, P. F. (2009). *Training mit aufmerksamkeitsgestörten Kindern* (Vol. 6. Auflage). Weinheim: Beltz PVU.

Lavigne, J. V., Dulcan, M. K., LeBailly, S. A., &Binns, H. J. (2012). Can Parent Reports Serve as a Proxy for Teacher Ratings in Medication Management of Attention-Deficit Hyperactivity Disorder? *Journal ofDevelopmental&BehavioralPediatrics, 33*(4), 336-342.

Leitlinie der Arbeitsgemeinschaft ADHS der Kinder- und Jugendärzte e. V. zur Diagnostik und Therapie bei ADHS (2007, mit Update des Kapitels „Medikamentöse Therapie“ März 2014).*ADHS bei Kindern und Jugendlichen.*Abgerufen am 10. März 2016.

Lidzba, K., Christiansen, C., & Drechsler, R. (2013). *Conners-3: Deutsche Adaptation der Conners 3rd Edition.[German adaptation and normalization of the Conners-3 questionnaires]*. Tübingen: Hans Huber Verlag.

Lofthouse, N., Arnold, L. E., Hersch, S., Hurt, E., DeBeus, R. (2012). A Review of Neurofeedback Treatment for Pediatric ADHD.*Journal of Attention Disorders, 16*(5), 351-372.

Marcovitch, S., &Zelazo, P. D. (2009).A hierarchical competing systems model of the emergence and early development of executive function.*Developmental Science*, *12*(1), 1–18. http://doi.org/10.1111/j.1467-7687.2008.00754.x

McBurnett, K.; Pfiffner, L. J. (2009). "Treatment of aggressive ADHD in children and adolescents: Conceptualization and treatment of comorbid behavior disorders". *Postgrad Med.* ***121*** *(6): 158–165.* doi*:*10.3810/pgm.2009.11.2084. PMID 19940426

McGee, R. A., Clark, S. E., & Symons, D. K. (2000).Does the Conners' Continuous Performance Test Aid in ADHD Diagnosis? *Journal of Abnormal Child Psychology*, *28*(5), 415-424.

Mobbs, O., Crépin, C., Thiéry, C., Golay, A., van der Linden, M. (2010): Obesity and the four facets of impulsivity. Changing obesity: Theories, facts and interventions.In*Patient Education and Counseling* 79 (3), pp. 372–377.DOI: 10.1016/j.pec.2010.03.003.

Moran, R. T., Abramson, N. R., Moran, S. V. (2014).*Managing Cultural Differences (9th edition).*Routledge: Taylor & Francis GroupLondon and New York

Muller, U., Asherson, P., Banaschewski, T., Buitelaar, J., Ebstein, R., Eisenberg, J., et al. (2011a). The impact of study design and diagnostic approach in a large multi-centre ADHD study.Part 1: ADHD symptompatterns. *BMC Psychiatry*, *11*(1), 54.

Muller, U., Asherson, P., Banaschewski, T., Buitelaar, J., Ebstein, R., Eisenberg, J., et al. (2011b). The impact of study design and diagnostic approach in a large multi-centre ADHD study: Part 2: Dimensional measures of psychopathology and intelligence. *BMC Psychiatry*, *11*(1), 55.

Müller, A., Mitchell, J. E., de Zwaan, M. (2015). Compulsive buying.*The American Journal on Addictions, 24(2):*132-137.

Müller, A., Mühlhans, B., Silbermann, A., Müller, U., Mertens, C., Horbach, T., de Zwaan, M. (2009). Pathologisches Kaufen und psychische Komorbidität. *PPmP-Psychotherapie· Psychosomatik· Medizinische Psychologie*, *59*(08), 291-299.

National Institute for Health and Clinical Excellence (NICE) (2009) Attention deficit hyperactivity disorder: diagnosis and management.Available at: https://www.nice.org.uk/guidance/cg72. [Accessed: 12. December 2016].

Nederkoorn, C., Braet, C., van Eijs, Y., Tanghe, A., Jansen, A. (2006).Why obese children cannot resist food: The role of impulsivity. *Eating Behaviors* 7 (4), pp. 315–322. DOI: 10.1016/j.eatbeh.2005.11.005.

Nichols, S. L., &Waschbusch, D. A. (2004).A Review of the Validity of Laboratory Cognitive Tasks Used to Assess Symptoms of ADHD. *Child Psychiatry & Human Development*, *34*(4), 297-315.

Nigg.J., Nikolas, M.(2008).Attention-Deficit/Hyperactivity disorder. In: *Child and Adolescent Psychopathology.* Hoboken, NJ: John Wiley & Sons.

Oken, B. S., Salinsky, M. C., Elsas, S. M.(2006). Vigilance, alertness, or sustained attention: physiological basis and measurement. *ClinNeurophysiol 117(9):*1885–1901.

Papadopoulos, T. C., Panayiotou, G., Spanoudis, G., Natsopoulos, D.(2005). Evidence of poor planning in children with attention deficits.*J Abnorm Child Psychol 33(5)*:611–623.

Petermann, F., & Wechsler, D. (2011).*Wechsler Intelligence Scale for Children (WISC - IV)* (Vol. 4. ed., German Version). Frankfurt/M.: Pearson.

Philipsen, A. (2006): Differential diagnosis and comorbidity of attention-deficit/hyperactivity disorder (ADHD) and borderline personality disorder (BPD) in adults. *Eur Arch Psychiatry ClinNeurosci*256 (1), pp. i42-i46. DOI: 10.1007/s00406-006-1006-2.

Polanczyk, G. V., Willcutt, E. G., Salum, G. A., Kieling, C., Rohde, L. A. (2014).ADHD prevalence estimates across three decades: an updated systematic review and meta-regression analysis.*International journal of epidemiology*.Band 43, Nummer 2, 434–442, doi:10.1093/ije/dyt261, PMID 24464188 (freierVolltext) (Review).

Ramirez, J. M., Andreu, J. M. and Fujihara, T. (2001). Cultural and sex differences in aggression: A comparison between Japanese and Spanish students using two different inventories. *Aggr. Behav., 27: 313–322.* doi:10.1002/ab.1014

Reh, V., Schmidt, M., Lam, L., Schimmelmann, B. G., Hebebrand, J., Rief, W., & Christiansen, H. (2013). Behavioral Assessment of Core ADHD Symptoms Using the QbTest.*Journal of Attention Disorders*.10.1177/1087054712472981.

Salbach-Andrae, H., Lenz, K., &Lehmkuhl, U. (2009).Patterns of agreement among parent, teacher and youth ratings in a referred sample.*European Psychiatry, 24*(5), 345-351.

Sattler, J. M. (1992). *Assessment of children: behavioral and clinical applications.* San Diego: Sattler Publ. Inc.

Scheres, A., Oosterlaan, J., & Sergeant, J. A. (2001).Response execution and inhibition in children with AD/HD and other disruptive disorders: the role of behavioural activation. *J Child PsycholPsychiatry, 42*, 347 - 357.

Schneider, S., &Margraf, J (2009)*Lehrbuch der Verhaltenstherapie: Störungen im Kindes- und Jugendalter.* Springer Medizin Verlag, Heidelberg 2009, S. 412–428.

Scholtens, S., Diamantopoulou, S., Tillman, C. M., &Rydell, A.-M. (2011). Effects of Symptoms of ADHD, ODD, and Cognitive Functioning on Social Acceptance and the Positive Illusory Bias in Children. *Journal of Attention Disorders, 16*(8), 685-696.

Schlack, R., Hölling, H., Kurth, B. M., & Huss, M. (2007).Die Prävalenz der Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS) bei Kindern und Jugendlichen in Deutschland [The prevalenceofattentiondeficithyperactivitydisorder (ADHD) in childrenandadolescents in Germany]. *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz, 50*, 827-835.

Schmidt, M., Reh, V., Müller, A.,Meyer, C., Rumpf, H.-J., Christiansen, H.(under Review by International Journal ofMethods in Psychiatric Research). Adult attention-deficit/hyperactivity disorder and the dilemma of differential diagnosis. Are the CAARS Rating Scales capable of distinguishing between ADHD and other psychiatric conditions displaying similar symptoms?

Schmidt, M., Reh, V., Hirsch, O., Rief, W., & Christiansen, H. (2013). Assessment of ADHD Symptoms and the Issue of Cultural Variation: Are Conners 3 Rating Scales Applicable to Children and Parents With Migration Background? *Journal of Attention Disorders*. 10.1177/1087054713493319.

Schmitt, J. (2013) Assoziation von Neurodermitis und Aufmerksamkeits-Defizit/Hyperaktivitäts-Syndrom. Meta-Analyse aktueller epidemiologischer Studien. *Zeitschrift für Kinder- und Jugendpsychiatrie und Psychotherapie, 41 (1), 35–44.* DOI 10.1024/1422-4917/a000208.

Scudder, L. E., Lipkin, P. H., Finding, R. L. (2015). ADHD: 2015's Most Important Research. Medscape.com, Pediatrics Disclosures, July 21, 2015

Sims, D. M., &Lonigan, C. J. (2012). Multi-method assessment of ADHD characteristics in preschool children: Relations between measures. *Early Childhood Research Quarterly, 27*, 329-337.

Slaats-Willemse, D., Swaab-Barneveld, H., de Sonneville, L., van der Meulen, E., Buitelaar, J. (2003) Deficient Response Inhibition as a Cognitive Endophenotype of ADHD.Journal of the American Academy of Child & Adolescent Psychiatry 42:1242-1248

Sobanski, E. (2006). Psychiatric comorbidity in adults with attention-deficit/hyperactivity disorder (ADHD).*Eur Arch Psychiatry ClinNeurosci*256 (1), pp. i26-i31. DOI: 10.1007/s00406-006-1004-4.

Steinhausen, H.-C., Navik, T., Baldursson, G., Curatolo, P., Lorenzo, M., Rodrigues Pereira, R., et al. (2006). Co-existing psychiatric problems in ADHD in the ADORE cohort. *European Child & Adolescent Psychiatry, 15*(1), i25-i29.

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin, Vol 128(5), Sep 2002, 825-848.* http://dx.doi.org/10.1037/0033-2909.128.5.825

Teicher, M. H., Ito, Y., Glod, C. A., & Barber, N. I. (1996).Objective Measurement of Hyperactivity and Attentional Problems in ADHD.*Journal of the American Academy of Child & Adolescent Psychiatry, 35*(3), 334-342.

Uebel, H., Albrecht, B.,Asherson, P., Börger, N., Butler, L., Chen, W., Christiansen, H., Heise, A., Kuntsi, J., Schäfer, U., Andreou, P., Manor, I., Marco, R., Miranda, A., Mulligan, A., Oades, R. D., Van Der Meere, J., Faraone, S. V., Rothenberger, A., Banaschewski, T. (2010) Performance variability, impulsivity errors and the impact of incentives as gender-independent endophenotypes for ADHD. *Journal of Child Psychology and Psychiatry 51:210-218*

Ulberstad F (2012) QbTest technical manual, rev. Ed. Qbtech AB, Stockholm, Sweden

U.S. Department of Health & Human Services - Centers for Disease Control and Prevention: *Attention-Deficit / Hyperactivity Disorder (ADHD) - DSM-5 Criteria for ADHD*. Online - laufend aktualisiert; enthält Listen der Einzelsymptome (abgerufen am 16. Januar 2016).

Van der Oord, S., Prins, P. J. M., Oosterlaan, J., &Emmelkamp, P. M. G. (2008). Efficacy of methylphenidate, psychosocial treatments and their combination in school-aged children with ADHD: A meta-analysis. *Clinical Psychology Review, 28*(5), 783-800.

Vogt, C., Williams, T. (2011).Early Identification of Stimulant Treatment Responders, Partial Responders and Non-Responders using Objective Measures in Children and Adolescents with Hyperkinetic Disorder.*Child and Adolescent Mental Health, 16*(3), 144-149.

Wehmeier, P. M., Dittmann, R. W., Banaschewski, T., & Schacht, A. (2012).Does Stimulant Pretreatment Modify Atomoxetine Effects on Core Symptoms of ADHD in Children Assessed by Quantitative Measurement Technology? *Journal of Attention Disorders,* 10.1177/1087054712445184.

Wehmeier, P. M., Schacht, A., Wolff, C., Otto, W. R., Dittmann, R. W., &Banaschewski, T. (2011). Neuropsychological Outcomes Across the Day in Children with Attention-Deficit/Hyperactivity Disorder Treated with Atomoxetine: Results from a Placebo-Controlled Study Using a Computer-Based Continuous Performance Test Combined with an Infra-Red Motion-tracking Device. *Journal of Child and Adolescent Psychopharmacology, 21*(5), 433-444.

Wender, P. H. (1995) *Attention-deficit hyperactivity disorder in adults.* Oxford University Press, New York-Oxford

Willcutt, E. G., Doyle, A. E., Nigg, J. T., Faraone, S. V., & Pennington, B. F. (2005). Validity of the Executive Function Theory of Attention-Deficit/Hyperactivity Disorder: A Meta-Analytic Review. *Biological Psychiatry, 57*(11), 1336-1346.

Willcutt E (2012) The Prevalence of DSM-IV Attention-Deficit/Hyperactivity Disorder: A Meta-Analytic Review. Neurotherapeutics 9:490-499

Zhou, K., Dempfle, A., Arcos-Burgos, M., Bakker, S. C., Banaschewski, T., Biederman, J., et al. (2008). Meta-analysis of genome-wide linkage scans of attention deficit hyperactivity disorder. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 147B*(8), 1392-1398.

Zimmermann, P., Gondan, M., &Fimm, B. (2002). *Testbatterie zur Aufmerksamkeitsprüfung für Kinder (KITAP)*. Herzogenrath: Psytest.

Article

Assessment of ADHD Symptoms and the Issue of Cultural Variation: Are Conners 3 Rating Scales Applicable to Children and Parents With Migration Background?

Journal of Attention Disorders
XX(X) 1–13

DOI: 10.1177/1087054713493319
jad.sagepub.com
SAGE

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Abstract

Objective: The objective was to evaluate whether Conners 3 (*Conners 3rd edition*) ratings of ADHD symptoms are robust to distortion by cultural variation when applied to children with migration background living in Germany. **Method:** From 2010 to 2011, Conners 3 data (self-rating, parent rating, and teacher rating) of 243 children with Turkish migration background, aged 6 to 16 years, were collected in various German schools. Allocation of items to latent factors was tested with confirmatory analyses. Reliability and validity of resulting factors was calculated and influence of acculturation, gender, and age on rating-modalities was examined. **Results:** Confirmatory factor analyses showed high model fits for all rating-modalities. Resulting scales had good reliability and validity. There was a small influence of acculturation on parent ratings of oppositional defiant disorder but not on ADHD core symptoms. **Conclusion:** Conners 3 ratings seem to be robust against influences of cultural variation. Their German translation can be utilized for children with Turkish migration background without limitation. *(J. of Att. Dis. 2013; XX(X) 1-XX)*

Keywords
ADHD, assessment, cultural variation

Introduction

Cultural variation is an issue when assessing psychopathological symptoms with psychometric measures across countries. Even given a faithful translation of a rating instrument, specific cultural characteristics might interfere with its reliability or validity (Canino & Bravo, 1994). On account of this, ADHD, with the three core symptoms of inattention, hyperactivity, and impulsivity, is a subject of a lively discussion. Is ADHD a mere cultural construct of modern Western society—an "American" problem (Timimi & Taylor, 2004)—or rather a psychiatric disorder (Faraone, Sergeant, Gillberg, & Biederman, 2003), with a primarily internal and biological etiology (Crawford, Kaplan, & Dewey, 2006; Schneider, Retz, Coogan, Thome, & Rösler, 2006)? Several investigators found prevalence rates in Europe to be significantly lower than those in northern America, and worldwide prevalence rates range from less than 1% to approximately 20% (Faraone et al., 2003; Skounti, Philalithis, & Galanakis, 2007). Polanczyk, De Lima, Horta, Biederman, and Rhode (2007), as well as Willcutt (2012), counter this allegation in systematic reviews that identify differences in assessment methods, such as choice of impairment criteria, diagnostic criteria, psychometric measures used, or sources of information to be primarily responsible for the huge variability in prevalence. Both reviews conclude that the overall and worldwide prevalence of ADHD is about 5% for children and adolescents when taking the mentioned differences in assessment into account.

However, even if uniform methods and rating criteria are applied, the endorsement of hyperactivity and disruptive behavior of children seems to vary across countries. The "International Multicenter ADHD Genetics Project (IMAGE)" is one of the largest research projects on ADHD, with more than 1,000 families that participated in 11 European centers (Kuntsi, Neale, Chen, Faraone, & Asherson, 2006). Although administration and instruments were the same in all locations, the mean number of ADHD symptoms differed

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significantly across countries (Müller et al., 2011), leading to the assumption that conceptual differences between cultures seem to influence ADHD assessment. There is, therefore, every indication that ADHD is a primarily biological condition with a stable worldwide prevalence, although the estimation of what kind of behavior is seen as problematic might differ across countries, ethnicities, and cultures. Neglecting the influence of cultural variation on the diagnostic process might lead to general diagnostic algorithms and cutoffs that are not suitable for classification in different countries (Canino & Alegrīa, 2008).

The Conners questionnaires are widely used tools for diagnostic and research purposes of ADHD. They assess core symptoms and related problems—especially oppositional defiant disorder and conduct disorder—based on *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*; 4th ed.; American Psychiatric Association [APA], 1994) criteria (Sparrow, 2010). There are forms for parents and teachers, as the diagnostic criteria require impairment across different settings, as well as self-rating forms for children. Normative data exist for Canadian and U.S. populations. Self-rating and parent scales were also adapted for the Spanish-speaking population of the United States. Those scales, or parts of them, have been translated into various languages and have been used in diverse cultural settings in and outside of North America. Countries where adaptations or translations of the teacher rating scales were used include Lebanon (Al Aghar, 2012), Iran (Ghanizadeh, Mohammadi, & Moini, 2008), Turkey (Dereboy, Senol, Sener, & Dereboy, 2007), Germany (Strehl et al., 2006), Sudan (Al-Awad & Sonuga-Barke, 2002), Poland (Kolakowski, Wolancyzk, & Liwsa, 1997), India (Rosenberg & Jani, 1995), Hong Kong (Luk, Leung, & Lee, 1988), Brazil (Brito, 1987), and Italy (O'Leary, Vivian, & Nisi, 1985). Parent rating scales have been adapted for Israel (Vaisman et al., 2008) and Russia (Joseph, Reisfeld, Tirosh, Silman, & Rennert, 2004). The IMAGE project used translations of the Conners' teacher and parent rating scales for diagnostic purposes in seven European countries (Netherlands, Ireland, Germany, Belgium, United Kingdom, Spain, and Switzerland), and Israel (Müller et al., 2011).

Although the scales are widely used internationally, difficulties with replication of the original subscale factors in those countries have been reported as well (Dereboy et al., 2007; O'Leary et al., 1985; Rosenberg & Jani, 1995). For example, the German version of the Conners Rating Scales (CRS) proved to result in different factor models for both the parent (Huss, Iseler, & Lehmkuhl, 2001) and teacher versions (Huss et al., 2002). Cross-cultural differences between the original version and the German adaptation were largest for hyperactivity and impulsivity symptoms in parent ratings (Huss et al., 2001). Large differences were found for conduct problems in the German teacher version (Huss et al., 2002).

The *Conners 3rd edition* (Conners 3; Conners, 2008) is the result of continuous development of the CRS and their revision (CRS-R; Conners, 1997). The full form assesses ADHD and related symptoms on 10 symptom and two validity scales. This version has only recently been translated into German (Lidzba, in press), and results of exploratory and confirmatory factor analyses (CFAs) indicated that the original American subscale factor structure could be maintained without modifications for the purpose of clinical assessment and process evaluation within Germany (Christiansen, Hirsch, Drechsler, & Lidzba, 2013).

But cultural variation is not only an issue when observing distinct geographical regions. Even within a region, beliefs, knowledge, and perception about problematic behavior might vary significantly, due to differences in ethics, socioeconomic standards, or origin of subgroups (Bussing, Gary, Mills, & Garvan, 2007). Huss, Hölling, Kurth, and Schlack (2008) demonstrated that families with migration backgrounds living in Germany simultaneously reported less ADHD diagnoses for their children, yet more ADHD symptoms. The general prevalence of ADHD in Germany is 5.1% for the 3- to 17-year-olds. Prevalence rates of ADHD in families with migration background are significantly lower (3.1%; Schlack, Hölling, Kurth, & Huss, 2007). This is attributed to various migrant-specific characteristics, help-seeking patterns, and cultural differences in tolerance of symptoms among them.

According to the Ministry of Foreign Affairs (Federal Office for Migration and Refugees, 2013; Federal Statistical Office, 2012), approximately three million people from Turkey constitute the largest subgroup with migration backgrounds in Germany. Those with low acculturation levels have been found to have significantly lower incomes, fewer German friends, lower educational levels, and poorer German language proficiency (Kiss & Kreienbrink, 2010). To date, this subgroup is assessed with the standard German assessment instruments when presenting in clinical contexts. This leads to the question, whether the actual German translation of the Conners 3 scales can also be applied to this subgroup.

Our goal is to test whether all rating-modalities (self-ratings, parent ratings, and teacher ratings) match the factorial structure of the original model and to calculate the reliability parameters of the hypothetical scales. In the second step, convergent and divergent validity among ratings is evaluated. Third, we test whether the acculturation level of parents has a moderating influence on the ratings of ADHD core symptoms and related disorders. Finally, possible discrepancies in symptom severity between raters, and influences of sex and age on ratings are analyzed.

Subjects and Method

Procedure and Subjects

This was a cross-sectional study on healthy children with Turkish migration background living in Germany, with or

Table 1. Demographics of Children (n = 243) With a Turkish Migration Background Living in Germany.

	Total	Male	Female
N	243	79 (32.5%)	164 (67.5%)
M age (*SD*)	11.64 (2.23)	11.11 (2.11)	11.90 (2.24)
School grade[a] (*SD*)	5.91 (2.18)	5.27 (2.01)	6.23 (2.15)
Diagnosis ADHD	10 (4.1%)	7 (2.9%)	3 (1.2%)

[a]Grades in Germany range from 1-4 (elementary school) to 5-10 (junior high school) to 11-13 (grammar school).

without German citizenship. Our sample consisted of 238 children self-ratings, 194 parent ratings, and 204 teacher ratings. Four parent rating forms had to be removed from the sample because more than five items (10%) were missing. All forms (self, parent, and teacher) were available for 152 children; in 86 cases, either parent or teacher ratings were missing. Five children did not complete the self-report, so only parent and/or teacher reports exist. Across all forms included in the final analyses, missing data on item level were 0.33%. Information on age, gender, and school grade was available for all children in the sample, along with the information on ADHD diagnoses. Information on educational level, nationality, and the language mainly used within the family was reported by 198 parents. As school graduations achieved in countries not belonging to the European Union are only rarely acknowledged, parents were first asked if they had any kind of German graduation level, and otherwise for the Turkish equivalent. Tables 1 and 2 show the details of the sample.

A study protocol in accordance with the criteria of the Declaration of Helsinki was reviewed and approved by the local institutional review board and by the school board of the German district Baden Wuerttemberg. Written informed consent was obtained from all participants, and their confidentiality was assured. From 2010 to 2011, subject data were collected through convenience sampling in different schools in Germany. Subjects were provided with a short study description, and asked to fill out the Conners 3 questionnaires for children, parents, and teachers. In addition, the parents were asked to answer questions on relevant sociodemographic parameters. Most subjects completed the questionnaires at home and sent them back to the Department of Clinical Psychology at the Philipps University of Marburg.

Method

The German Conners 3 for ADHD rating scales (C3D-C/P/T) in children and young adolescents. The German translation of the Conners 3 assesses ADHD symptoms and related problematic behaviors in children and young adolescents between 6 and 18 years of age (Lidzba, in press). The assessment of symptom frequency is based on the evaluation of parents (parent rating), teachers (teacher rating), and the children themselves (self-rating). Symptoms are rated on a Likert-type scale from 0 (*not at all/never*) to 3 (*very much/very frequently*).

The long form of the self-rating scales (C3D-C) consists of 94 items assessing not only ADHD core symptoms but also related problems in executive functions, learning problems, aggression, and peer/family relations. The C3D features screener items for anxiety and depression. Scales that relate directly to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; APA, 2000) diagnostic criteria (symptom scales) are included for ADHD (inattention and hyperactivity/impulsivity) as well as for the most commonly co-occurring group of disorders—disruptive behavior disorders with conduct disorder and oppositional defiant disorder that consist of 44 items in total. Our analysis focused on those four symptom scales (Inattention [INA], Hyperactivity/Impulsivity [H/I], Conduct Disorder [CD], and Oppositional Defiant Disorder [ODD]), because of their relevance in clinical evaluation.

The parent (C3D-P) and teacher (C3D-T) ratings differ from the self-report primarily in wording of questions. Items in the self-report are formulated in the first person singular (e.g., "it is hard for me to pay attention … "), whereas items for parent and teacher ratings are formulated in the third-person singular (e.g., "the child described doesn't pay attention … "). The long form of the parent rating scales (C3D-P) contains 105 items, with 44 symptom scale items, while the long form of the teacher rating scales (C3D-T) consists of 111 items, with 42 symptom scale items. The two missing items in the teacher questionnaire address conduct problems hard to rate for teachers (e.g., *staying out at night* and *bolting from home*).

Acculturation Assessment Scale index. We used a modified version of this instrument originally developed by Günay and Haag (1990) that measures the acculturation level of people with Turkish migration background living in Germany. Acculturation means acceptance of values, standards, and lifestyle of the immigration country. In its original form, the scale consists of 24 items. To reduce redundancy (e.g., different items asking for preferred language when consuming different types of media), an exploratory factor analysis was calculated that yielded two factors. One of these was composed of items addressing geographical features (e.g., place of birth), while the other one consisted of items associated with acculturation (e.g., preferred language, social contacts, national identity). The latter scale was used to calculate levels of acculturation. Items that showed high similarities in content—and thus very high correlations—with other items were removed to create a heterogeneous scale. The modified scale consists of 7 items on a 3-point Likert-type scale, for example, "German

Table 2. Demographics of Parents (n = 198) With a Turkish Migration Background Living in Germany.

	German		Turkish	Both	No statement
Nationality (%)	73 (36.9%)		113 (57.1%)	9 (4.5%)	3 (1.5%)
Family language (%)	2 (1.0%)		71 (35.9%)	123 (62.1%)	2 (1.0%)
Educational level	German		Turkish		
None		12 (6.0%)			
Basic school	–		21 (10.6%)		
Middle school	113 (57.0%)		16 (8.1%)		
High school	16 (8.1%)		20 (10.1%)		
Total		198 (100%)			

language speaking ability" from 1 (*not at all*/*rudimentary*) to 3 (*good*/*very good*). Cronbach's alpha is .757, which is acceptable, especially as items are relatively heterogeneous in terms of content (M inter-item correlation = .344).

Statistical Analysis

All raw data were stored in a database in Marburg (Department of Clinical Psychology, Philipps University of Marburg). Data reduction and analyses were carried out using the statistical package SPSS 18, including AMOS 18, for structural equation modeling.

First, CFA was conducted for the German translations of self-report, parent rating, and teacher rating to assess whether the data of the sample of children with Turkish migration background resulted in a model fit comparable with the original American version, as this was the case with the German normative sample (Christiansen et al., 2013). The confirmatory analysis was based on the 44 items (42 items in the teacher rating) that compose the four symptom scales: INA, H/I, ODD, and CD. Factors were allowed to correlate, as factor correlations in the original validation sample were substantial (Conners, 2008). Unweighted least squares (ULS) were used for estimation, as this procedure makes no assumption on distribution or scaling properties. Indices used to evaluate model fits are explained below.

Root mean square residual (RMR). The RMR displays discrepancies between the implied model and empirical data, and ranges from 0 to 1, with values close to 0 indicating less discrepancy. A value smaller than .05 indicates a good model fit (Byrne, 1998), and values smaller than .08 an acceptable fit (Hu & Bentler, 1999).

Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI). The GFI shows the amount of observed covariance explained by the covariance implied by the model (Tabachnick & Fidell, 2007). It ranges from 0 to 1, and values close to 1 indicate a high amount of explained variance. A cutoff point of .90 has been recommended, but Miles and Shevlin (1998) rather suggested values equal or larger than .95 to indicate a good fit. The AGFI adjusts this value by degrees of freedom, and favors parsimonious models—models with more degrees of freedom—over complex ones. AGFI values of .90 or larger indicate a good model fit (Hooper, Coughlan, & Mullen, 2008).

Normed Fit Index (NFI). The NFI is an incremental fit index that compares the hypothetic model with an independent model (that assumes indicators within the model to be entirely uncorrelated). Values range from 0 to 1, with values close to 1 indicating a strong preference for the hypothetic model. Values equal or larger than .95 indicate good model fit (Hu & Bentler, 1999), while values equal or larger than 0.90 are acceptable (Bentler & Bonnet, 1980).

Parsimony Normed Fit Index (PNFI). The PNFI index evaluates the parsimony of the model and prefers models that produce reliable estimates, while being nonrestrictive. Values range from 0 to 1, with values close to 1 indicating high parsimony. No thresholds have been recommended, but values around .5 are often reported in samples that produce otherwise good fit indices (Mulaik et al., 1989).

Because there was no evidence against the assumption that data were missing completely at random (Little's MCAR [Missing Completely at Random] test, p = .338 for self-ratings, p = .998 for parent ratings, and p = .999 for teacher ratings), missing values were imputed with the expectation–maximization algorithm. After conduction of the factor analyses, Cronbach's alpha was estimated for the established scales.

In the second step, correlations between identical scales across rating-modalities (self-rating, parent rating, and teacher rating) were calculated to evaluate convergent validity. Divergent validity was determined by comparing correlations between different scales across all rating-modalities. Results are displayed in a multitrait–multimethod matrix (MTMM).

Subsequently, correlations between all rating-modalities and the acculturation index were calculated to determine possible influences of cultural variation. Bonferroni–Holm corrections were used to adjust error rates for multiple testing of correlations.

Table 3. Fit Indices and Thresholds for Self-Rating and Parent and Teacher Ratings.

Fit indices	Self-rating	Parent rating	Teacher rating	Threshold
RMR	.036	.028	.033	<.05
GFI	.944	.963	.973	>.95
AGFI	.938	.959	.970	>.90
NFI	.911	.950	.968	>.95
PNFI	.863	.900	.914	>.60

Note. RMR = root mean square residual; GFI = Goodness of Fit Index; AGFI = Adjusted Goodness of Fit Index; NFI = Normed Fit Index; PNFI = Parsimony Normed Fit Index.

In the final step, a repeated-measure MANOVA with rating-modality as a within-subject factor, gender as a between-subject factor, and age and acculturation index as covariates was calculated across all symptom scales to examine whether differences between rating-modalities and gender influenced behavior ratings. Post hoc analyses of significant differences were analyzed with ANOVAs, repeated-measure ANOVAs, and *t* tests.

Effect sizes are reported as eta squares (η^2) for analyses of variance, or Cohen's *d* (*d*) for *t* tests. Cohen (1988) defined an η^2 of 0.01 / $d = 0.2$ as a small effect size, one of $\eta^2 = 0.06$ / $d = 0.5$ as medium, and one of $\eta^2 = 0.14$ / $d = 0.8$ as large.

Results

Results of CFA and Cronbach's Alpha for the Self-Report Sample (C3D-C)

Data from 238 self-reports were entered into the analysis. Both RMR and AGFI suggested a good fit of the data for the assumed model, while PNFI suggested the theoretical model to be highly parsimonious. GFI and NFI values were within the acceptable range. Table 3 gives an overview of the established fit-index values and thresholds.

Most factor loadings on the scales INA, H/I, and ODD were in the acceptable range with values greater than 0.30, and only one item on each scale loading less. Six items allocated to the scale (CD) loaded lower than 0.30 on that factor. This might be due to reduced variance, as items allocated to that scale (i.e., items regarding sexual assault or armed robbery) assess behaviors rarely displayed by children around the age of 12 years. Furthermore, social desirability might further influence ratings, contributing to reduced variance. Finally, heterogeneity of items allocated to that scale might result in lower factor loadings.

Table 4 shows the standardized factor loadings of the C3D-C self-rating items on their hypothesized factors, loadings on other factors that are within the range of 0.1 of the hypothesized factor, and intercorrelations between factors. Apart from Items 21, 39, and 42, items assigned to the factor Inattention show medium to high loadings on their respective factor, and noticeably lower loadings on all other factors. Results regarding H/I, ODD, and CD are mixed, because lots of double or triple loadings exist. The internal consistency of all four factors of the self-rating form was acceptable with the following Cronbach's alpha values: INA, $\alpha = .79$; H/I, $\alpha = .77$; ODD, $\alpha = .72$; and CD, $\alpha = .76$.

To sum it up, our sample of children with Turkish migration background matches the factorial structure of the original Conners 3 self-rating forms well, with the model being highly parsimonious with acceptable fit-indices and an adequate internal consistency of the resulting scales.

Results of CFA and Cronbach's Alpha for the Parent-Report Sample (C3D-P)

Data from 194 parent reports were entered into the analysis. This sample of parent ratings successfully replicated the factorial structure of the original Conners 3 symptom scales. The resulting model is highly parsimonious with excellent fit-indices and a good internal consistency of the resulting scales (see Table 3). The internal consistency of all four factors was good with the following Cronbach's alpha values: INA, $\alpha = .83$; H/, $\alpha = .86$; ODD, $\alpha = .81$; and CD, $\alpha = .87$.

With the exception of one item on the factor CD (*sexual assault*), factor loadings on all scales were in the acceptable range with values greater than 0.30. Table 5 shows the standardized factor loadings of the C3D-P items on their hypothesized factors and intercorrelations between factors.

Of the 15 items assigned to CD, 11 showed at least medium loadings on this factor and no substantial loadings on any other factor with 10 of those even showing high loadings of ≥.50. Another three items showed small to medium loadings on ODD as well. These results indicate a strong factor that, despite high correlations (.574-.765) with the other factors, depicts a distinct latent trait—namely, "serious disruptive behaviors"—rather clearly.

Almost all items assigned to the factors INA, H/I, and ODD show substantial loadings on at least one other factor, apart from the one they were originally allocated to. This suggests a higher order factor that subsumes those three factors. This higher order factor resembles the International Classification of Diseases, Tenth Revision (ICD-10) category of hyperkinetic conduct disorder (ICD-10, F90.1; World Health Organization [WHO], 2004).

Results of CFA and Cronbach's Alpha for the Teacher-Report Sample (C3D-T)

Data from 204 teacher reports were entered into the analysis. Analogous to self-ratings and parent ratings, the replication of the original Conners 3 symptom scales was successful. All fit-indices suggest a good fit of the data with the assumed model (see Table 3). The internal consistency

Table 4. Interfactor Correlation According to Confirmatory Factor Analysis and Standardized Factor Loadings of the Items on Their Hypothesized Factors for the Self-Rating Sample.

Conners item (number)	INA	H/I	ODD	CD
Factor 1: INA		.798	.709	.541
Problems with paying attention (31)	.514			
With making mistakes (39)	.272	.217	.193	
Keeping focus on tasks (63)	.607			
Keeping focus while listening (42)	.427	.341		
Following instructions (61)	.662			
Finishing tasks (17)	.586			
With organizing oneself (21)	.434	.347		
With tasks that require thinking (51)	.371			
With loosing things (5)	.622			
With distractibility (77)	.547			
With forgetfulness (32)	.577			
Factor 2: H/I	.798		.900	.726
Problems with fidgetiness (60)		.708	.637	
With staying seated (64)	.379	.475	.428	
With moving when not supposed to (20)	.364	.456	.410	
With restlessness (7)		.604	.544	
With doing things quietly (84)		.649	.584	
With feelings of inner unrest (66)	.361	.452	.407	
With constantly moving (55)	.125	.156	.140	.113
With being quiet (34)	.370	.463	.417	
Bursting out during conversation (9)	.282	.353	.318	.256
With waiting (27)		.564	.508	
With interrupting people (6)		.580	.522	
Factor 3: ODD	.709	.900		.790
With controlling temper (67)		.576	.640	
With bickering (24)		.510	.567	
With following orders (1)	.206	.262	.291	.230
With antagonizing others (3)		.431	.479	.379
With denouncing others (62)		.510	.566	
With getting annoyed easily (74)		.385	.427	.338
With irritability (87)		.543	.603	
With being vengeful (94)		.450	.500	
Factor 4: CD	.541	.726	.790	
Problems with menacing others (25)			.375	.474
With being provocative (38)				.562
With using weapons (59)		.195	.212	.268
With being aggressive (86)			.375	.474
With torturing animals (47)		.183	.199	.252
With robbery (13)		.205	.223	.282
With setting things on fire (72)			.335	.424
With vandalism (82)		.204	.222	.281
With burglary (78)		.171	.186	.235
With lying (16)				.552
With stealing (52)	.089	.119	.130	.164
With staying out at night (91)			.358	.453
With bolting from home (8)			.314	.398
With truancy (33)				.640

Note. INA = Inattention; H/I = Hyperactivity/Impulsivity; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder. In addition, loadings on factors other than the hypothesized factors differing by less than .1 are shown.

Table 5. Interfactor Correlation According to Confirmatory Factor Analysis and Standardized Factor Loadings of the Items on Their Hypothesized Factors for the Parent Rating and Teacher Rating Sample.

	Parent rating				Teacher rating			
Conners item (number)	INA	H/I	ODD	CD	INA	H/I	ODD	CD
Factor 1: INA		.846	.837	.607		.680	.641	.575
Problems with paying attention (47/36)	.586	.496	.491		.629			
Keeping focus on tasks (95/111)	.388	.328	.325		.718			
Keeping focus while listening (35/69)	.637	.539			.727			
Following instructions (68/73)	.680				.655			
Finishing tasks (79/57)	.659				.636			
With organizing oneself (84/103)	.535	.453	.448		.756			
With tasks that require effort (28/60)	.500	.423	.419		.643			
With loosing things (97/92)	.557	.471	.467		.623			
With distractibility (101/23)	.649	.549			.777			
With forgetfulness (2/88)	.589	.498	.493		.655			
Factor 2: H/I	.846		.880	.574	.680		.788	.722
Problems with fidgetiness (98/4)		.733	.645			.774		
With staying seated (93/1)		.687	.605			.766		
With moving when not supposed to (69/24)	.518	.612	.538			.716		
With restlessness (99/7)		.808	.711			.691		
With doing things quietly (71/32)		.695	.611			.737		
With feelings of inner unrest (54/17)	.539	.637	.560			.565		
With constantly moving (45/78)	.455	.537	.473			.720		
With being quiet (3/50)	.403	.477	.419			.734		
Bursting out during conversation (43/9)		.658	.579			.696		
With waiting (61/76)	348	.411	.362			.713		
With interrupting people (104/29)		.709	.624			.813		
Factor 3: ODD	.837	.880		.765	.641	.788		.994
With controlling temper (14/62)	.440	.463	.526				.742	.738
With bickering (102/47)		.604	.687				.683	.679
With following orders (94/71)	.426	.448	.509				.746	.742
With antagonizing others (59/59)	.365	.384	.436				.785	.780
With denouncing others (21/64)	.490	.515	.585				.766	.762
With getting annoyed easily (73/59)		.607	.690				.773	.769
With irritability (73/56)		.666	.757				.731	.727
With being vengeful (57/51)	.461	.484	.550				.595	.591
Factor 4: CD	.607	.574	.765		.575	.722	.994	
Problems with menacing others (16/98)				.641			.569	.572
With being provocative (30/105)				.696			.740	.744
With using weapons (27/14)				.544		.224	.309	.310
With being aggressive (39/35)				.529			.552	.555
With torturing animals (41/21)			.250	.327		.170	.234	.236
With robbery (96/27)				.499	.034	.043	.059	.060
With setting things on fire (78/61))				.438	.098	.124	.170	.171
With vandalism (65/10)				.569			.565	.568
With burglary (89/90)			.249	.325	.053	.066	.091	.092
With lying (56/40)				.767			.790	.794
With stealing (58/31)				.636		.230	.317	.319
With staying out at night (91/-)				.583	—	—	—	—
With bolting from home (76/-)			.317	.414	—	—	—	—
With truancy (6/54)				.534		.170	.234	.236
With sexual assault (11/33)	.139	.131	.175	.229	.083	.104	.143	.144

Note. INA = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional defiant disorder; CD = conduct disorder. In addition, loadings on factors other than the hypothesized factors differing by less than .1 are shown.

Table 6. Multitrait–Multimethod Matrix (n = 152).

	Self-rating			Parent rating				Teacher rating			
	H/I	ODD	CD	INA	H/I	ODD	CD	INA	H/I	ODD	CD
Self-rating											
INA	.631**	.504**	.432**	.582**	.409**	.388**	.289**	.537**	.393**	.376**	.428**
H/I		.626**	.488**	.390**	.479**	.449**	.246*	.356**	.509**	.383**	.406**
ODD			.560**	.237*	.344**	.394**	*ns*	*ns*	.282**	.289**	.285**
CD				.229*	*ns*	.253*	.273*	.235*	*ns*	*ns*	.312**
Parent rating											
INA					.702**	.692**	.426**	.501**	.317**	.357**	.390**
H/I						.780**	.440**	.302**	.365**	.384**	.307**
ODD							.491**	.241*	.316**	.407**	.441**
CD								*ns*	*ns*	*ns*	.252*
Teacher rating											
INA									.637**	.591**	.484**
H/I										.762**	.578**
ODD											.735**

Note. Significant correlations were found between sum scores of all scales across all forms (self-rating, parent rating, and teacher rating). INA = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional defiant disorder; CD = conduct disorder; *ns* = not statistically significant.
*Values significant at α = .05 level. **Values significant at α = .01 level (Bonferroni–Holm adjusted).

of all four factors was good with the following Cronbach's alpha values: INA, α = .83; H/I, α = .86; ODD, α = .81; and CD, α = .87.

All factor loadings on all four scales were in the acceptable range with values greater than 0.30. Table 5 shows the standardized factor loadings of the C3D-T items on their hypothesized factors, and intercorrelations between factors. Items assigned to INA and H/I showed consistently high loadings on their respective factors, and considerably lower loadings on all other factors. These results are indicative that teachers are relatively precise when attributing a certain behavior to a distinct ADHD core symptom.

Items assigned to either ODD or CD showed consistently high loadings on both factors and considerably lower loadings on all other factors. As with the parent ratings, a higher order factor possibly subsumed both factors. This higher order factor could be described as "volitional disruptive behaviors." Loading patterns of teacher ratings most closely resembled a simple structure, and therefore seem most suited for differentiation of specific symptoms.

Convergent and Divergent Validity of Rating-Modalities

Monotrait–heteromethod correlations between rating-modalities (self-rating, and parent and teacher ratings) were high for INA (ranging from .501 to .582), medium to high for H/I (.365 to .509), medium for ODD (.289 to .407), and small to medium for CD (.252 to .312).

Except in one case, inattention and hyperactivity correlated highest with their counterparts across all rating-modalities, for example, self-ratings of inattention showed higher correlations with parent ratings of inattention (monotrait correlation) than with any other scale; this indicates good convergent validity. Only the correlation between ODD teacher ratings and hyperactivity parent ratings (.384) was stronger than the monotrait correlation for hyperactivity (.365).

In the case of ODD and CD, results were mixed, with parent- or teacher-rated ODD and CD correlating higher with self-rated inattention or hyperactivity than with their counterparts. Table 6 shows the details of interrating correlations. Furthermore, children's self-ratings of hyperactivity correlated more strongly with either parent rating (.479) or teacher rating (.509) than those two rating-modalities with each other (.365).

Correlations between constructs within the same rating-modality (heterotrait–monomethod correlations) were strong with values up to .780 (hyperactivity/ODD) in parent ratings. As CFA demonstrated high factor correlations, this was expected.

Correlations Between All Rating-Modalities and Acculturation Index

There is a small, negative correlation between parent ratings of ODD and acculturation index (r = −.189, p = .020). It seems that a higher acculturation index goes along with less reported symptoms of ODD, and vice versa. When adjusting for multiple testing, this relationship is no longer significant (adjusted α = .0042). No other significant correlations (or trends) of the acculturation index with self-rating, parent rating, or teacher rating were found. Though the influence of acculturation on parent ratings of ODD seems small but not

Table 7. Item Means and Standard Deviations of Symptom Scales Across All Rating-Modalities (n = 152).

Sex	Scale	Self-rating	Parent rating	Teacher rating
Male	Inattention	.99 (.530)	.80 (.579)	.99 (.746)
	Hyperactivity	.75 (.513)	.66 (.569)	.65 (.659)
	ODD	.84 (.458)	.55 (.547)	.55 (.617)
	CD	.21 (.258)	.12 (.237)	.17 (.258)
Female	Inattention	.81 (.470)	.56 (.634)	.56 (.695)
	Hyperactivity	.60 (.421)	.52 (.451)	.45 (.576)
	ODD	.72 (.363)	.41 (.378)	.34 (.494)
	CD	.10 (.157)	.05 (.103)	.09 (.166)
Total	Inattention	.86 (.495)	.63 (.500)	.69 (.600)
	Hyperactivity	.65 (.455)	.57 (.493)	.52 (.608)
	ODD	.76 (.397)	.46 (.440)	.40 (.542)
	CD	.13 (.200)	.07 (.160)	.11 (.201)

Note. Standard deviations are given in parentheses. Values are subdivided further to show effects accountable to sex differences. ODD = oppositional defiant disorder; CD = conduct disorder.

totally incidental, we conservatively decided to include this measure as a covariate in all further analyses.

Mean Differences Across Rating-Modalities: Influence of Age, Sex, and Acculturation

Children's self-ratings across all problem behaviors showed higher means than parent and teacher ratings (see Table 7), though this difference was fully mediated by their age. This was illustrated by a significant effect of covariation for age, Wilks's lambda = .908, $F(145.000) = 3.66$, $p = .007$, $\eta^2 = .092$. Younger children have higher means than older ones. When age is controlled for, differences between means of children, parent, and teacher ratings disappear, Wilks's lambda = .945, $F(141.000) = 1.04$, $p = .421$, $\eta^2 = .055$.

There was a significant main effect for gender, Wilks's lambda = .880, $F(145.000) = 4.93$, $p = .001$, $\eta^2 = .120$. Boys achieved higher ratings than girls across all problem behaviors and all rating-modalities.

There was no significant moderating or mediating influence for degree of acculturation, Wilks's lambda = .964, $F(145.000) = 1.36$, $p = .249$, $\eta^2 = .036$, although there is was a trend for ratings of ODD to be higher when parents had a lower acculturation index ($F = 3.60$, $p = .060$, $\eta^2 = .024$).

Discussion

The goal of the study presented was to evaluate whether the German adaptation of the Conners 3 is robust to distortion by cultural variation, when presented to people with a Turkish migration background living in Germany. The CFAs with items of the Conners 3 *DSM-IV* symptom scales of the original American study showed consistently good model fits in our sample of children. Analyses of the different scales revealed that (a) due to high correlations between rating-modalities, convergent validity is given, and (b) self-ratings and parent and teacher ratings do not differ in estimation of symptom severity. Clinical ratings according to those original structures seem justified for this subgroup of children. This is important because prevalence rates of ADHD in families with migration backgrounds living in Germany are substantially lower than in families without migration background (Schlack et al., 2007). Therefore, it was our aim to examine if differences in awareness and/or estimation of problematic behaviors across subcultures might be responsible for this phenomenon, which in turn might influence psychometric ratings. This is important not only for clinical practice but also for research on ADHD. Considering that many studies today are international multicenter studies, it is of high importance to rely on psychometrically sound instruments with cross-cultural comparable factor structures that meet diagnostic requirements as formulated in the existing diagnostic manuals (*DSM-IV*/ICD-10; APA, 2000; WHO, 2004) and guidelines (National Institute for Health and Care Excellence, 2008).

When interpreting the following results, it is important to note that intercorrelations between scales are consistently high (>.5) across all rating-modalities, reflecting the strong relation between ADHD core symptoms and related disruptive behaviors.

When analyzing children's self-ratings on item level, items associated with absentminded and distractible behavior almost exclusively load on the factor Inattention, resembling a simple structure, while lots of double or triple loadings exist for all other factors. Thus, self-reports of children seem to differentiate well between internalizing (Inattention) and externalizing (H/I, ODD, CD) problem behaviors, but not between different manifestations of externalizing behaviors.

Parent ratings, however, show a clear distinction between CD and all other factors, but have problems differentiating between core symptoms of ADHD and ODD, matching results by Gadow and Nolan (2002).

Loading patterns of teacher-rated ADHD core symptoms resemble a simple structure most clearly, as they distinguish between the three dimensions inattention, hyperactivity/impulsivity, and disruptive behaviors. However, factor intercorrelation between ODD and CD is huge (.994) for teacher ratings. Teachers seem to have difficulties to differentiate milder problem behavior (ODD) from more serious disruptive behaviors (CD). It is possible that any kind of problematic externalizing and oppositional behavior at school is rated to be more severe by teachers, whereas parents differentiate the milder forms of opposition more clearly from the stronger forms of conduct disorders.

Looking at convergent validity, inattention consistently shows the highest correlations across all rating-modalities.

Convergent validity is acceptable for all other dimensions, though notably lower for parent and teacher ratings of H/I, ODD, and CD. This might reflect the aforementioned greater difficulty of parents to differentiate between those dimensions of externalizing behaviors (Gadow & Nolan, 2002), and to rather perceive this more in the sense of hyperkinetic conduct problems. Thus, parents and teachers seem to perceive and rate hyperactive/impulsive behavior differently, which may be attributed to the circumstance that both witness behaviors of children in different contexts. This assumption is supported by a number of studies, who found little to no association between parent and teacher ratings (Efstratopoulou, Simons, & Janssen, 2013; Lavigne, Dulcan, LeBailly, & Binns, 2012; Sims & Lonigan, 2012). This does not necessarily mean that one type of informant is providing invalid or unreliable information (Reid & Maag, 1994). For example, given that teachers, compared with parents, are more familiar with age-appropriate behavior of children, it might be possible that teachers are more tolerant toward the problem behavior of a particular child (Antrop, Roeyers, Oosterlaan, & Van Oost, 2002). Correlations of children's self-/parent ratings (.479) and children's self-/teacher ratings (.509) of H/I are higher than parent/teacher ratings (.365). It seems that children rate their own hyperactive/impulsive behavior rather accurately, probably because they experience—and more importantly receive feedback for—their behavior in both contexts.

As can be seen in the analyses on scale level, age has a mediating effect. Self-ratings of older children resemble parent and teacher ratings more than self-ratings of younger children. Possibly, very young children are overcharged when asked to rate their behavior out of the actual context, as their ability for logical, abstract, and deductive thinking is still developing until about 11 years of age (Petermann, Niebank, & Scheithauer, 2004). Varni, Limbers, and Burwinkle (2007) demonstrated that children as young as 5 years old can reliably and validly self-report their "health-related quality of life," although correlations between parent and children ratings increase substantially when children are 10 years or older. Therefore, it may be reasonable to attribute this discrepancy to the large variability of age and therefore to different stages of cognitive development of children and teenagers in this sample. Nevertheless, as displayed by the results, even when possibly exaggerating, young children show high consistence in their self-evaluation.

As prevalence rates, and thus perception of symptoms of ADHD and other disruptive behavioral disorders, between boys and girls differ strongly (Gershon & Gershon, 2002), effects of sex were to be expected. Findings of the literature could be replicated in this respect with boys consistently scoring higher than girls across all behaviors and rating-modalities.

Finally, besides an influence on parent ratings of ODD that vanished when correcting for multiple testing, the level of parental acculturation did not influence ratings of parents, teachers, or children. Parents with lower acculturation index reported slightly higher ODD scores than those with a higher acculturation index. It seems that these parents perceive behavior of their offspring more critically. This is interesting, as Dereboy et al. (2007) reported problems replicating the scale CD for the parent ratings in the Turkish adaptation, but found no such issues for the scale H/I. Furthermore, a study on prevalence rates of ADHD and ODD based on *DSM-IV* criteria in Turkey (Erşan, Doğan, Doğan, & Sümer, 2004) revealed higher rates of ODD, but not ADHD, compared with prevalence rates in other countries. According to these findings, the awareness of defiant behavior seems to be more strongly affected by cultural diversity than core symptoms of ADHD.

Limitations

One limitation is the absence of a control sample of German children without migration background. On item level, a control group would have offered the opportunity for multiple-group CFA, thus testing the equivalence of models dependent on different levels of invariance (Weiber & Mühlhaus, 2010). On scale level, differences between parent groups could have been analyzed. However, teachers constitute a suitable control group, as they are independent of parental migration background. As parent and teacher ratings on symptom frequency in our sample do not differ from each other significantly, it seems sensible to assume the same for control parents. Furthermore, we specifically controlled for possible influences of acculturation.

Another problem is the high prevalence of girls in this sample, possibly because of selection bias. As effects of gender were controlled for and boys in the sample, according to expectations, scored higher than girls on all scales, this sample still seems to represent the basic population fairly.

Conclusion

There are no objections using the German translation of the Conners 3 *DSM-IV* symptom scales to assess ADHD and related behaviors in children with Turkish migration background. CFA revealed that our data strongly correspond with the assumed factor structure of the original Conners 3. The reliability of the resulting scales is adequate. The same applies to convergent and divergent validity parameters. Although there are small effects of acculturation on parental appraisal of oppositional behavior, these alone do not justify a special adaptation for use in clinical or research settings, especially because these effects vanish when controlling for multiple testing. Regarding ADHD core symptoms—inattention and hyperactivity/impulsivity—the Conners 3 questionnaires seem "culture fair."

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

Al Aghar, T. (2012). *Assessing attention deficit hyperactivity disorder in Lebanon: The adaptation of the Conners' Teacher Rating Scale for use with Lebanese children* (Unpublished doctoral dissertation). University of Leicester, UK. Retrieved from https://lra.le.ac.uk/handle/2381/10310

Al-Awad, A. M.E.-H., & Sonuga-Barke, E. J. S. (2002). The application of the Conners' Rating Scales to a Sudanese sample: An analysis of parents' and teachers' ratings of childhood behaviour problems. *Psychology and Psychotherapy: Theory, Research and Practice*, *75*, 177-187.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

Antrop, I., Roeyers, H., Oosterlaan, J., & Van Oost, P. (2002). Agreement between parent and teacher ratings of disruptive behavior disorders in children with clinically diagnosed ADHD. *Journal of Psychopathology and Behavioral Assessment*, *24*, 67-73.

Bentler, P. M., & Bonnet, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*, 588-606.

Brito, G. N. O. (1987). The Conners Abbreviated Teacher Rating Scale: Development of norms in Brazil. *Journal of Abnormal Child Psychology*, *15*, 511-518.

Bussing, R., Gary, F. A., Mills, T. L., & Garvan, C. W. (2007). Cultural variations in parental health beliefs, knowledge, and information sources related to attention-deficit/hyperactivity disorder. *Journal of Family Issues*, *28*, 291-318.

Byrne, B. (1998). *Structural equation modeling with LISREL, PRELIS and SIMPLIS*. Mahwah, NJ: Lawrence-Erlbaum.

Canino, G., & Alegr□a, M. (2008). Psychiatric diagnosis—Is it universal or relative to culture? *Journal of Child Psychology and Psychiatry*, *49*, 237-250.

Canino, G., & Bravo, M. (1994). The adaptation and testing of diagnostic and outcome measures for cross-cultural research. *International Review of Psychiatry*, *6*, 281-286.

Christiansen, H., Hirsch, O., Drechsler, R., & Lidzba, K. (2013). *German validation of the Conners' 3rd Rating Scales for parents, teachers and children: Factor structure and normative data*. Manuscript submitted for publication.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence-Erlbaum.

Conners, C. K. (1997). *Conners' Rating Scales–Revised (CRS-R)*. Toronto, Ontario, Canada: Multi-Health Systems.

Conners, C. K. (2008). *Conners 3rd edition* (3rd ed.). Toronto, Ontario, Canada: Multi-Health Systems.

Crawford, S. G., Kaplan, B. J., & Dewey, D. (2006). Effects of coexisting disorders on cognition and behavior in children with ADHD. *Journal of Attention Disorders*, *10*, 192-199.

Dereboy, C., Senol, S., Sener, S., & Dereboy, F. (2007). Validation of the Turkish versions of the Short-Form Conners' Teacher and Parent Rating Scales. *Turk Psikiyatri Derg*, *18*, 48-58.

Efstratopoulou, M., Simons, J., & Janssen, R. (2013). Concordance among physical educators', teachers', and parents' perceptions of attention problems in children. *Journal of Attention Disorders*, *17*, 437-443.

Erşan, E. E., Doğan, O., Doğan, S., & Sümer, H. (2004). The distribution of symptoms of attention-deficit/hyperactivity disorder and oppositional defiant disorder in school age children in Turkey. *European Child & Adolescent Psychiatry*, *13*, 354-361.

Faraone, S., Sergeant, J., Gillberg, C., & Biederman, J. (2003). The worldwide prevalence of ADHD: Is it an American condition? *World Psychiatry*, *2*, 104-113.

Federal Office for Migration and Refugees, Federal Ministry of the Interior. (2013). *Migrationsbericht* [Migration report]. Retrieved from http://www.bamf.de/SharedDocs/Anlagen/DE/Publikationen/Migrationsberichte/migrationsbericht-2011.pdf?__blob=publicationFile

Federal Statistical Office. (2012). *Bevölkerung und Erwerbstätigkeit: Ausländische Bevölkerung* [Population and occupation: Foreign population]. Retrieved from https://www.destatis.de/DE/Publikationen/Thematisch/Bevoelkerung/MigrationIntegration/AuslaendBevoelkerung2010200117004.pdf?__blob=publicationFile

Gadow, K. D., & Nolan, E. E. (2002). Differences between preschool children with ODD, ADHD, and ODD+ADHD symptoms. *Journal of Child Psychology and Psychiatry*, *43*, 191-201.

Gershon, J., & Gershon, J. (2002). A meta-analytic review of gender differences in ADHD. *Journal of Attention Disorders*, *5*, 143-154.

Ghanizadeh, A., Mohammadi, M. R., & Moini, R. (2008). Comorbidity of psychiatric disorders and parental psychiatric disorders in a sample of Iranian children With ADHD. *Journal of Attention Disorders*, *12*, 149-155.

Günay, E., & Haag, A. (1990). *Krankheit in der Emigration. Eine Studie an türkischen Patientinnen in der Allgemeinpraxis aus psychosomatischer Sicht* [Disorder and emigration. A study with female Turkish patients in psychosomatic treatment] (Vol. 40). Stuttgart, Germany: Thieme.

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, *6*, 53-60.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*, 1-55.

Huss, M., Hölling, H., Kurth, B.-M., & Schlack, R. (2008). How often are German children and adolescents diagnosed with ADHD? Prevalence based on the judgment of health care professionals: Results of the German health and examination survey (KiGGS). *European Child & Adolescent Psychiatry*, *17*(1), 52-58.

Huss, M., Iseler, A., & Lehmkuhl, U. (2001). Interkultureller Vergleich der Conners-Skalen: Lässt sich die US-amerikanische Faktorenstruktur an einer deutschen Klinikstichprobe replizieren? [Cross-cultural comparison of the Conners scales. Is it possible to replicate the original factor structure on a German clinical sample?]. *Zeitschrift für Kinder- und Jugendpsychiatrie und Psychotherapie*, *29*(1), 16-24.

Huss, M., Stadler, C., Salbach, H., Mayer, P., Ahle, M., & Lehmkuhl, U. (2002). ADHS im Lehrerurteil: Ein Vergleich von Klinik- und Normstichprobe anhand der Conners-Skalen [ADHD and teacher rating: Comparison of clinical and normative sample based on Conners rating scales]. *Kindheit und Entwicklung*, *11*(2), 90-97.

Joseph, N. B., Reisfeld, D., Tirosh, E., Silman, Z., & Rennert, G. (2004). Neurobehavioral and cognitive performances of children exposed to low-dose radiation in the Chernobyl accident. *American Journal of Epidemiology*, *160*, 453-459.

Kiss, A., & Kreienbrink, A. (2010). *Fortschritte der Integration* [Advancements of integration]. Retrieved from http://www.bamf.de/SharedDocs/Anlagen/DE/Publikationen/Forschungsberichte/fb08-fortschritte-der-integration.pdf?__blob=publicationFile

Kolakowski, A., Wolancyzk, T., & Liwsa, M. (1997). The Polish version of Conners Rating Scales—Preliminary report. *European Psychiatry*, *12*, (Suppl. 2), S227.

Kuntsi, J., Neale, B. M., Chen, W., Faraone, S. V., & Asherson, P. (2006). The IMAGE project: Methodological issues for the molecular genetic analysis of ADHD. *Behavioral and Brain Functions*, *2*, 27.

Lavigne, J. V., Dulcan, M. K., LeBailly, S. A., & Binns, H. J. (2012). Can parent reports serve as a proxy for teacher ratings in medication management of attention-deficit hyperactivity disorder? *Journal of Developmental & Behavioral Pediatrics*, *33*, 336-342. doi:10.1097/DBP.0b013e31824afea1

Lidzba, K. (in press). *Deutsche Adaptation und Normierung der Conners-3 Fragebögen* [German adaptation and normalization of the Conners-3 questionnaires]. Tübingen: Universitätsklinik für Kinder- und Jugendmedizin.

Luk, S. L., Leung, P. W. L., & Lee, P. L. M. (1988). Conners' Teacher Rating Scale in Chinese children in Hong Kong. *Journal of Child Psychology and Psychiatry*, *29*, 165-174.

Miles, J. N. V., & Shevlin, M. (1998). Effects of sample size, model specification and factor loadings on the GFI in confirmatory factor analysis. *Personality and Individual Differences*, *25*, 85-90.

Mulaik, S. A., James, L. R., Van Alstine, J., Bennet, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equation models. *Psychological Bulletin*, *105*, 430-445.

Müller, U., Asherson, P., Banaschewski, T., Buitelaar, J., Ebstein, R., Eisenberg, J., & Steinhausen, H. C. (2011). The impact of study design and diagnostic approach in a large multicentre ADHD study: Part 1. ADHD symptom patterns. *BMC Psychiatry*, *11*(1), 54.

National Institute for Health and Care Excellence. (2008). *ADHD: Diagnosis and management of ADHD in children, young people and adults*. Retrieved from http://publications.nice.org.uk/attention-deficit-hyperactivity-disorder-cg72/guidance#diagnosis-of-adhd

O'Leary, K. D., Vivian, D., & Nisi, A. (1985). Hyperactivity in Italy. *Journal of Abnormal Child Psychology*, *13*, 485-500.

Petermann, F., Niebank, K., & Scheithauer, H. (2004). *Entwicklungswissenschaft* [Developmental science]. Heidelberg, Germany: Springer.

Polanczyk, G., De Lima, M. S., Horta, B. L., Biederman, J., & Rohde, L. A. (2007). The worldwide prevalence of ADHD: A systematic review and metaregression analysis. *The American Journal of Psychiatry*, *164*, 942-948.

Reid, R., & Maag, J. W. (1994). How many fidgets in a pretty much: A critique of behavior rating scales for identifying students with ADHD. *Journal of School Psychology*, *32*, 339-354.

Rosenberg, L. A., & Jani, S. (1995). Cross-cultural studies with the Conners Rating Scales. *Journal of Clinical Psychology*, *51*, 820-826.

Schlack, R., Hölling, H., Kurth, B. M., & Huss, M. (2007). Die Prävalenz der Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS) bei Kindern und Jugendlichen in Deutschland [The prevalence of attention deficit hyperactivity disorder (ADHD) in children and adolescents in Germany]. *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz*, *50*, 827-835.

Schneider, M., Retz, W., Coogan, A., Thome, J., & Rösler, M. (2006). Anatomical and functional brain imaging in adult attention-deficit/hyperactivity disorder (ADHD)—A neurological view. *European Archives of Psychiatry & Clinical Neuroscience*, *256*(1), i32-i41.

Sims, D. M., & Lonigan, C. J. (2012). Multi-method assessment of ADHD characteristics in preschool children: Relations between measures. *Early Childhood Research Quarterly*, *27*, 329-337.

Skounti, M., Philalithis, A., & Galanakis, E. (2007). Variations in prevalence of attention deficit hyperactivity disorder worldwide. *European Journal of Pediatrics*, *166*, 117-123.

Sparrow, E. P. (2010). *Essentials of Conners behavior assessments*. Hoboken, NJ: Wiley.

Strehl, U., Leins, U., Goth, G., Klinger, C., Hinterberger, T., & Birbaumer, N. (2006). Self-regulation of slow cortical potentials: A new treatment for children with attention-deficit/hyperactivity disorder. *Pediatrics*, *118*, e1530-e1540.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). New York, NY: Allyn & Bacon.

Timimi, S., & Taylor, E. (2004). ADHD is best understood as a cultural construct. *British Journal of Psychiatry*, *184*, 8-9.

Vaisman, N., Kaysar, N., Zaruk-Adasha, Y., Pelled, D., Brichon, G., Zwingelstein, G., & Bodennec, J. (2008). Correlation between changes in blood fatty acid composition and visual sustained attention performance in children with inattention: Effect of dietary n-3 fatty acids containing phospholipids. *American Journal of Clinical Nutrition*, *87*, 1170-1180.

Varni, J. W., Limbers, C. A., & Burwinkle, T. M. (2007). How young can children reliably and validly self-report their health-related quality of life? An analysis of 8,591 children across age subgroups with the PedsQL 4.0 Generic Core Scales. *Health and Quality of Life Outcomes*, *5*, 1.

Weiber, R., & Mühlhaus, D. (2010). *Strukturgleichungsmodellierung* [Structural Equation Modelling]. Heidelberg, Germany: Springer.

Willcutt, E. (2012). The prevalence of *DSM-IV* attention-deficit/hyperactivity disorder: A meta-analytic review. *Neurotherapeutics*, 9, 490-499.

World Health Organization. (2004). *International statistical classification of diseases and health related problems*. Geneva, Switzerland: Author.

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Title:

Adult attention-deficit/hyperactivity disorder and the dilemma of differential diagnosis. Are the CAARS Rating Scales capable of distinguishing between ADHD and other psychiatric conditions displaying similar symptoms?

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Abstract

Objective: Attention-deficit/hyperactivity disorder is a life-long impairing disorder affecting attention, impulse, and motor control. Though there are numerous studies on diagnostics of ADHD across the different age groups, studies focusing on patient groups that display impairments similar to ADHD are rare. The aim of the current study is to assess the Conners Adult ADHD Rating Scales self-ratings (CAARS: S) ability to successfully discriminate ADHD from other disorders associated with impulse control problems.

Methods: 1429 participants provided CAARS self-ratings (ADHD: n=123, Obesity: n=135, Pathological Buying: n=62, Problem Gambling: n=517, Healthy Controls: n=592). Mean differences for the different groups were calculated across all scales, while sensitivity and specificity parameters were based on discriminant analysis and manual cut-offs.

Results: ADHD patients scored significantly higher than either the control or the other patient groups across all scales (d=0.52 to d=2.06). Discriminant analysis resulted in good prediction rates (sensitivity 80%, specificity 85%), as did the discrimination for the different groups based on the manual cut-offs.

Conclusion: The CAARS self-rating scale differentiates successfully between ADHD and other disorders related to problems with behavioral inhibition. Especially the scale *ADHD-Index,* consisting of 12 items, seems to be efficient in discriminating ADHD-patients from other clinical groups.

Introduction

Today it is well agreed that Attention Deficit/Hyperactivity Disorder (ADHD) often persists into adulthood with prevalence rates falling between 4% to 5% (Bell, 2011; Davidson, 2007; Kessler et al., 2006; Polanczyk et al., 2007; Simon et al., 2009). According to the European Consensus Statement on diagnosis and treatment of adult ADHD (Kooij et al., 2010) the gold standard in diagnosis includes four components: a) DSM (American Psychiatric Association, 2000;2013) based clinical interview with the specific assessment of adult ADHD symptoms, b) standardized questionnaires for the assessment of adult ADHD symptoms, c) appraisal of school- or work certificates and d) neuropsychological tests. This elaborate procedure might not easily translate into everyday clinical practice due to various factors, for example economic restrictions, time limits regarding the diagnostic process or simply lack of knowledge on adult ADHD (Kooij et al., 2010).

Another reason, why a reliable diagnosis of adult ADHD proves to be a challenging task is that many of the symptoms of ADHD are similar to symptoms of other disorders. Impaired concentration, a symptom common of major depression, dysthymia, posttraumatic stress disorder or generalized anxiety disorder, might resemble the inattentiveness of adult ADHD. Restlessness and excessive talking, elements of the hyperactivity component of ADHD, may be difficult to differentiate from the psycho-motor agitation associated with mania, hypomania, major depressive disorder or generalized anxiety disorder (McCann et al., 2004). Impulsivity, as seen in ADHD, may be difficult to distinguish from characteristics such as in manic or hypo-manic episodes, or from impulsive behavior inherent to borderline personality disorder and other disorders related to poor impulse control (e. g. pathological buying, pathological gambling and compulsive sexual behavior).

Furthermore, adult ADHD is a disorder with high comorbidity rates of up to 75 % (Kessler et al., 2006; Kooij et al., 2010; Sobanski, 2006). Specifically, disorders such as affective, anxiety, substance use, eating, and somatoform disorders (Cumyn et al., 2007) as well as personality disorder like obsessive compulsive, anti-social, and borderline personality disorder (Philipsen, 2006; Cumyn et al., 2007; Edvinsson et al., 2013; Miller et al., 2007; Van Emmerik-van Oortmerssen et al., 2014) often co-occur with ADHD. Those disorders, especially the ones associated with deficits in memory, attention, speed, fluency and executive functions might contribute to neuropsychological deficits commonly found in

patients with ADHD (Schoechlin et al., 2005). ADHD is also highly correlated with pathological gambling (Carlton et al., 1992). One study of pathological gamblers found that over one third (38%) of the sample displayed pronounced symptoms of adult ADHD (Specker et al., 1995). Breyer et al. (2009) even assumes that adult ADHD might mediate the connection between impulsivity and pathological gambling. Individuals with pathological buying- another patient group related to poor impulse control - suffer from greater lifetime psychiatric comorbidity and elevated levels of ADHD symptoms, self-reported depression, trait impulsivity, and novelty seeking (Black et al., 2012). Studies researching the connection between obesity and adult ADHD within the US population revealed that individuals with adult ADHD have increased odds of being overweight, have a higher-than-average body mass index (BMI) score and are significantly more often affected by obesity compared to subjects without ADHD (de Zwaan et al., 2011; Cortese et al., 2010; Pagoto et al., 2009). In summary it can be emphasized, that the older the patient, the more difficult it might be to establish whether a patient with a history of inattention, hyperactivity, impulsivity, low self-esteem, and deficits in executive functions has ADHD, another disorder or both, since various other disorders might be associated with the deficits observed (Schoechlin et al., 2005).

There is a large body of literature on the differentiation of adult ADHD and healthy/community control groups that usually results in satisfying differentiation rates both for neuropsychological assessments (Hirsch et al., 2016; Schoechlin et al., 2005; Hervey et al., 2004) as well as for rating scales (Barkley et al., 2008; Christiansen et al., 2012; Hirsch et al., 2013). However, problems arise when the aim is the distinction between adult patients with ADHD and other patient groups with similar symptoms (Riccio et al., 2001). Under those circumstancescorrect classification rates of neuropsychological assessments drop significantly, i. e. from over 80 % to as low as only 36-41 % (Edebol et al., 2012). When using rating scale assessments false positive rates increase dramatically. McCann et al. (2004) tested the ability of three different Rating scales - the Adult Rating Scale (ARS), the Attention-Deficit Scale for Adults (ADSA), and the Symptom Inventory for ADHD (SI-ADHD) - to discriminate adult patients with ADHD from adult patients with Major Depression, Bipolar Disorder, anxiety disorders, and substance abuse/dependence disorders. Based on criterion cut-off scores of those inventories, individuals diagnosed with Major Depression or Dysthymia produced up to 73.9% false positives (up to 67.4% false positives across all other

clinical patients). Solanto et al. (2004) tested the predictive value of the Brown Attention Deficit Disorder Scale and a Continuous Performance Test and concluded that sensitivity and specificity parameters did not warrant a meaningful contribution to the differential diagnosis of ADHD and internalizing disorders.

The Conners Adult ADHD Rating Scales are well established and assess specific adult ADHD symptoms based on DSM-IV criteria with norms for males/females and four different age groups. The reported psychometric properties of the CAARS are highly satisfying, and they discriminate patients from healthy control subjects well (sensitivity 87%, specificity 85%, positive predictive value 85%, negative predictive value 87%, total correct classification rate 86%; Conners et al., 1999). Similar results have been found for translations of the CAARS (i. e. German adaptation: Christiansen et al., 2011; 2012; Hirsch et al., 2013). However, Van Vorhees et al. (2011) examined the ability of the Conners Adult ADHD Rating Scales (CAARS, Conners et al., 1999) to differentiate between ADHD and other Axis I disorders associated with attention problems. They found that patients with ADHD were likely to be indistinguishable from patients with anxiety and mood disorders when solely relying on the CAARS ratings-scales for diagnosis. Furthermore, there are gender effects demonstrating that females with ADHD are more difficult to differentiate from other patient groups than males (Barkley et al., 2008).

Thus, the goal of the current study is to establish whether the CAARS discriminates between different patient groups that present with symptoms similar and/or frequently comorbid to adult ADHD, specifically disorders associated with lack of behavioral inhibition like obesity, pathological buying, and pathological gambling. For control purposes a healthy control group was added to the sample.

2. Methods

2.1 Subjects and Procedure

A total of 1464 subjects participated in the study and completed the short form of the CAARS (CAARS-S: S) consisting of 26 items. Of those, 24 subjects had to be removed due to missing data (more than 10% missing items). Another 11 subjects had to be removed due to lack of variability in response patterns. Thus, a total of 1429 subjects remained, of which 837 belonged to one of the clinical groups (ADHD: n = 123, Obesity: n = 135, Pathological Buying:

n = 62, ProblemGambling: n = 517), while 592 had no diagnosed psychiatric disorder (referred to as control group). Data of people with obesity and pathological buying were gathered at the Department of Psychosomatic Medicine and Psychotherapy of the Hannover Medical School (MHH). The first group consisted of bariatric surgery candidates with morbid obesity (BMI≥40 kg/m^2) and was seen within the routine preoperative psychosomatic evaluation. The second group consisted of patients with pathological buying who were seeking psychotherapy treatment. All patients were assessed at baseline (i.e. before starting the psychotherapy). Subjects with problem gambling behavior were recruited via a nationwide general population survey (N=15,023) and from different populations with a high risk of gambling problems (gambling locations, via media announcements, outpatient addiction services, debt counselors, probation assistants, self-help groups and specialized inpatient treatment facilities; for further details see Meyer et al., 2015). All participants were diagnosed based on the respective DSM-IV (American Psychiatric Association, 2000) criteria by clinical professionals at the respective locations. The presence of pathological buying was defined using the impulse control disorder module of the Structured Clinical Interview for DSM-IV disorders (SCID-ICD); First et al., 2002). Problem gambling was diagnosed with the gambling section of the Composite International Diagnostic Interview (CIDI; World Health Organization, 2009). Problem gambling was defined by fulfilling at least one DSM-IV criterion for pathological gambling over the lifecourse. Among the sample with problem gambling 385 subjects fulfilled the DSM-IV criteria for pathological gambling. All members of the control group derived either from an online-sample (n=540) or a sample gathered at the Philipps University Marburg (n=52). Data of patients with ADHD were gathered either online (n=84) or at the outpatient clinic of the Department of Clinical Psychology at the Philipps University Marburg (n=39). Online subjects were allocated to the clinical group when they reported a clinician based lifetime diagnosis of ADHD. The mean values of the CAARS scales between the online samples and their respective clinical sample from Marburg (ADHD and control-group) were compared to assess the validity of the online sample. No significant differences were detected. Information on age and gender was available for all members of the sample, as well as BMI for bariatric surgery candidates with extreme obesity. Mean BMI of this latter group was 47.1 kg/m^2 with a standard deviation of 8.47. Table 1 shows the details of the samples.

Please insert Table 1

The study was approved by the local review boards of each institution involved, written informed consent was obtained from all participants, and their confidentiality was assured. From 2010 to 2013, subject data was collected through convenience sampling at the participating centers (see above). All subjects were provided with ashort study description, and were asked to fill out the CAARS questionnaire. Data was then sent to the Department of Psychology at the Philipps University Marburg.

2.2 Measures

The German Conners Adult ADHD Rating Scales(CAARS)

The German adaptation of the CAARS (Conners et al., 1999; German version: Christiansen et al., 2014) assesses ADHD core-symptoms and related problematic behavior in adults 18 years of age and older.Assessment of symptom frequency is based on the evaluation of self- and observer ratings. Symptoms are rated on a Likert-scale from "0" (not at all/never) to "3" (very much/very frequently). The long forms of the CAARS (CAARS-S/O: L) consist of 66 items assessing ADHD core-symptoms on four scales (*Inattention/Memory Problems, Hyperactivity/Restlessness and Impulsivity/Emotional Lability*, *Problems with Self-Concept)*. Furthermore, two scales that relate directly to the DSM-IV-TR diagnostic criteria (*DSM-IV Inattentive Symptoms* and *DSM-IV Hyperactive/Impulsive Symptoms*) are included.Items in the self-rating are formulated in the first person singular (i.e. '*I have trouble keeping my attention focused…'*), whereas items for observer ratings are formulated in the third-person singular (i.e. '*the person being described has trouble keeping attention focused…'*).The short forms of the Instrument (CAARS-S/O: S) consist of 26 items assessing ADHD core-symptoms and self-concept, while the screening version (CAARS-S/O: SV) consists of 30 items and puts emphasis on the DSM-IV-TR Diagnostic criteria. This analysis used the short version of the self-rating form (CAARS-S: S) for all calculations. All versions allow calculation of the *ADHD-Index*, which contains the 12 items best suited to discriminate clinical from control groups according to the manual (Conners et al., 1999). Furthermore calculation of an Inconsistency Index assists in detecting unmotivated, haphazardly or deliberately distorting response behavior. Check Table 2 for a list of items and their associated scales.

Please insert Table 2

2.3 Statistical Analysis

All raw data was stored at a database in Marburg (Department of Psychology, Philipps University Marburg). Analyses of data were carried out using the statistical packages SPSS 18.Since there was no evidence against the assumption that data was missing completely at random (Little MCAR-Test, p = .436), missing values were imputed with the expectation-maximization algorithm.

In accordance with the literature (Christiansen et al., 2011), there were small negative correlations between all scales and age ranging from -.103 (Impulsivity/Emotional Lability) to -.152 (Hyperactivity/Restlessness) in the current study. Older participants produced lower values on all scales. There was a small correlation between *Problems with Self-Concept* and gender (.135), which is also in accordance with the literature (Christiansen et al., 2011). No other significant correlations between gender and the other subscales of the CAARS exist. Consequently, age and gender were included as covariates for all further analyses.

In a first step, the mean scores of the CAARS-S: S sub-scales (*Inattention/Memory, Hyperactivity/Restlessness, Impulsivity/Emotional Lability, Problems with Self-concept* and *ADHD-Index*) were computed as dependent variables in a MANCOVA with *diagnosis* as the between-subject-factor and *age/gender* as covariates. Post-hoc analyses of significant differences were analyzed with ANOVAS and T-tests using Bonferroni correction for multiple testing.

Subsequently, a discriminant-analysis was calculated initially using a stepwise procedure to extract the scales most useful in determining group membership based on the values of the CAARS scales. CAARS subscales were then subjected to discriminant analysis in order to determine sensitivity and specificity parameters.

In a final step, the *Inconsistency-Index* was calculated for each form, whereupon subjects with an inconsistent answer style (via manual guidelines) were removed from the sample. The remaining forms were then used to calculate sensitivity and specificity

parameters comparing our sample values to the percentiles/standard deviations of the German CAARS normative sample.

Effect sizes are reported as eta-squares (η^2) for analyses of variance, or Cohen's d (d) for T-tests. Cohen (1988) defined an η^2 of 0.01/d = 0.2 as a small effect size, one of η^2 = 0.06/d = 0.5 as medium, and one of η^2 = 0.14/d = 0.8 as large.

3. Results

Please insert Table 3

3.1 Mean differences of ADHD-patients andall other groups

Patients with ADHD score significantly higher than either the control or the other patient groups across all scales. Effect sizes are consistently high; comparing the group with obesity to the group with ADHD on the scale*Problems with Self-Concept*results in a medium effect size. Overall, this pattern indicates that the items and scales of the CAARS assess specific symptom clusters of ADHD, not just inattentive-, hyperactive- and impulsive behaviors in general.

Please insert Table 4

Differences between the other groups (obesity, buying, gambling, control)

Regarding the scale AD*HD-Index,* there is a significant difference between patients with problem gambling and the control group, but the effect size is small. All other groups do not differ significantly in their means on the ADHD-Index.

The group with obese patients scores lowest on the *Hyperactivity/Restlessness* scale (see Table 2), which results in a significant medium-sized difference compared to the group with patients with problem gambling. Compared to problem gamblers, the control-group scores significantly lower as well, the effect size is small tough.

Considering the scale *Impulsivity/Emotional Lability*, the problem gamblers score higher than the control-group resulting in a small, tough significant difference.

Regarding *Problems with Self Concept*, significant medium-sized differences exist between the group of obese patients and the control-group, as well as between the group of obese patients and problem gamblers.

Mean differences across groups, influences of age and gender

Since the Box test reached significance (Box's M=179.219, $F_{60,278861.801}$, p= .000), the Wilks's Lambda distribution is used for multivariate hypothesis testing. There is a significant main effect for diagnosis (Wilk's Lambda = 25.478, $F_{1418.000}$ = 4.93, p =.000, η^2 =.082), and, as expected, significant effects of both the covariates age (Wilk's Lambda = .979, $F_{1418.000}$ = 5.984, p= .000, η^2= .021) and gender (Wilk's Lambda = .962, $F_{1418.000}$ = 11.143, p= .000, η^2 = .038). The older the participant, the lower the values across all scales; female participants score higher than males on the *Self-Concept* scale, regardless of group membership; all other scales are not affected by gender differences. See table 3 for between-group comparisons.

3.2 Stepwise Discriminant Analysis of the CAARS-Subscales for all groups

Due to an insufficient minimum partial F-value, *Impulsivity/Emotional Lability* was excluded from the discriminant analysis. Based on their partial F-values, the remaining scales were included in the following order: *ADHD-Index*, *Self-Concept*, *Inattention/Memory Problems,* and *Hyperactivity/Restlessness*. The Eigenvalue (.312) and canonical correlation (4.88) of the resulting discriminant function indicates a good group separation between patients with ADHD and the other groups, as does the significant Chi-square test (χ^2=387.42, df=4, p< .001). The standardized canonical discriminant function coefficients represent the partial weight of variables within the discriminant function (see table 4 for details). Values within the structure matrix represent the total correlation between variables and the discriminant function. Again, both coefficients indicate the relevance of the ADHD-Index for the discriminant function.

Please insert Table 5

Table 5.1 displays the results of the group allocation based on the discriminant function. Of the participants with an ADHD diagnosis 80 % are correctly classified as such (sensitivity), while 85% of the other participants have been correctly classified as well (specifity). Of the originally grouped cases, 17.5 % have not been correctly classified based on their CAARS results.

3.3 Sensitivity and specificity when diagnosing ADHD based on manual cut-offs

Table 5.2 displays sensitivity and specificity values when predicting group membership with the *ADHD-Index* using cut-offs from the manual of the German CAARS adaptation (Christiansen et al., 2014). Of the participants with an ADHD-diagnosis 89 % (no change when adjusted for the *Inconsistency-Index)* are correctly classified while only 68% (73 % when adjusted for the *Inconsistency-Index*) of the other participants are correctly classified when compared to highest 15% of the norm group (> 1 SD). When comparing the participants' values to the highest 2% of the norm group (> 2 SD), specificity rises to 84% (87 % when adjusted), while sensitivity drops to 76% (78 % when adjusted; see table 5.3).

Discussion

This investigation examined the discriminative ability of the self-rating form of the CAARS-S using a large sample of adults recruited from various university clinical institutions as well as an online sample. Our goal was to provide information whether the CAARS could reliably differentiate between patients with ADHD and other disorders associated witha lack of impulse control, namely patients suffering from problem gambling and pathological buying as well as extremely obese patients. A community control group was included to ensure good comparability of the data.

Differing from the results on the inability of the CAARS to distinguish between patients with ADHD and patients with mood and anxiety disorders (Van Vorhees et al., 2011), we could demonstrate that members of the ADHD-group score considerably higher than members of all other clinical groups and the control group on all five scales of the CAARS. This indicates that the items and scales of the CAARS assess specific clusters of

symptoms that are highly associated with typical problems of people with ADHD, not just unspecific inattentive, hyperactive and impulsive behaviors.

The most distinct difference between the ADHD-group and all other groups was observed for the scale *Inattention/Memory problems*. Ratings of the ADHD-group were remarkably higher than those of any other group (effect sizes ranging from d=1.61 to d=2.06), while all other groups ratings do not differ significantly from each other. This was to be expected, since inattention/poor concentration (e.g. keeping track of tasks or organizing oneself) is not one of the core symptoms of the other patient groups included in this study.

Accordingly, differences between the ADHD-group and all other groups on the scales *Hyperactivity/Restlessness* and *Impulsivity/Emotional Lability*were slightly lower (d=1.28 to d=1.80), but still strong. While the group of patients with problem gambling scored considerably lower than the ADHD-group, they scored significantly higher than the control-group on both scales. Even when the effect sizes can be described as small at best (d= .34), patients with gambling problems seem to exhibit increased symptoms of impulsivity, although the difference to the control group is smaller than expected. Peculiarly, neither the groups of patients with pathological buying or obesity show any significant differences on both scales compared to the control-group. This is particularly odd with respect to the *Impulsivity/Emotional Lability* scale, since Müller et al. (2009) suggest to define pathological buying either as an "unspecified, abnormal habit or impulse control disorder", while McElroy et al. (1994) emphasize intrusive, irresistible and meaningless impulses as requirements for a diagnosis of compulsive buying disorder. Of note, current state of research indicates that pathological buying can be viewed as a behavioral addiction (Müller et al. 2015). With respect to the development and maintenance of obesity, impulsivity has been identified as a central feature (Mobbs et al., 2010; Nederkoorn et al., 2006; Stice, 2002; Bonato et al., 1983). This is especially true with regard to bariatric surgery patients. Previous research demonstrated high levels of food-related as well as food-unrelated impulsivity in this group (Gerlach et al., 2015; Georgiadiu et al., 2014). When taking a closer look at the items that constitute the scale *Impulsivity/Emotional Lability* (see Table 2) it becomes clear that these mainly focus on impetuous and inappropriate expressions of emotional states (e. g. problems with angry outbursts). Pathological buying and gambling count among the behavioral addictions, while the development of an addiction in general is strongly associated with a lack of other functional emotion regulation strategies. The difference in

impulsivity between patients with ADHD and patients with behavioral addictions in this survey might stem from different strategies when it comes to emotional regulation. Patients with addictions tend to dampen aversive emotions through use of a substance or a behavior that makes impetuous and inappropriate expressions of emotional states less likely to surface.The same logic might be applied to the differences between groups regarding the scale *Hyperactivity/Restlessness* that is mainly composed of items describing insufficient resources in dealing with boredom which Fisher (1993) defines as an unpleasant, transient affective state in which the individual feels a pervasive lack of interest and difficulty concentrating on the current activity.

Both the group of ADHD patients as well as the one with obesity score significantly higher than the healthy control group on the *Problems with Self-Concept* scale. The elevated values of the group of obese patients are not surprising when one considers the current literature on that matter. A three-year longitudinal study of O'Dea (2006) displays substantially lower values across all self-concept domains within the group of females with the highest BMI, while Franklin et al. (2006) assume that obesity impacts self-perception of children entering adolescence in selected areas of competence, like sports, physical appearance and peer engagement. However, the difference of magnitude between both groups is remarkable. The enormous level of impairment reported by patients with ADHD, even in contrast to people with obesity, hints at the negative impact on quality of life that the core symptoms of ADHD impose on patients afflicted by this condition. Our sample of people with ADHD seems to suffer from aversive emotional states with a higher frequency and intensity than the rest of the sample, even compared to treatment-seeking patients suffering from behavioral addictions or extreme obesity. This seems not only to be a result of negative learning experience brought about by the disorders symptoms, but also a central feature of ADHD, as for instance postulated by the dopamine theory of attention deficit hyperactivity disorder (Levy, 1991).The regulating effect of addictive substances or behaviors on aversive emotional states might be responsible for the enormous differences between the ADHD-group and the other clinical groups in our sample, as it could explain why people suffering from addictions do not much differ from the healthy control group when regarding impulsivity, hyperactivity and problems with self-concept. In other words, people with addictions display scores within normal limits, because their substance use or behavior prevents problematic demeanors or aversive emotional states from surfacing. Furthermore,

if people with ADHD experience heightened levels of emotional stress, as our results suggest, this supports the assumption that ADHD represents a significant risk factor for the onset and development of addictions (Ohlmeier et al., 2007), since comorbid substance use disorders in adult ADHD might be connected to self-medication. A study of Wilens et al. (2007) demonstrated that 70 % of the participants were using substances to improve their mood, to sleep better, or for reasons other than "getting high". He assumes this kind of 'self-medication' to be especially common among individuals whose ADHD remains undiagnosed or who have been diagnosed, but never underwent appropriate treatment. Furthermore 80 of the 517 subjects with problem gambling were diagnosed with a comorbid axis I mood or anxiety disorder (Bischof et al., 2013), which did not - contrary to the findings of Van Vorhees et al. (2011) - noticeably bias the accuracy of the CAARS-S when differentiating groups. This strengthens the assumption that the CAARS-S might be universally effective in distinguishing ADHD from disorders who emphasize on inhibition of aversive emotional states.

Age and gender had a mediating, but only small effect on the CAARS ratings. Older subjects produced lower ratings on all scales confirming findings of the literature that demonstrated that age is significantly associated with a decline of total ADHD symptoms, as well as the symptoms of hyperactivity, impulsivity, and inattention (Biederman et al., 2000). Female subjects across all groups produced slightly higher ratings on the scale *Problems with Self-Concept* which is also in accordance with the literature (Kling et al., 1999).

When taking a closer look at the discriminant analysis and the resulting squared standardized canonical discriminant function coefficients, it is noteworthy that four scales explained 76% of the variance of the discriminant function *(ADHD-Index* 40 %, *Inattention/Memory* 20 %, *Problems with Self-Concept* 11 %, *Hyperactivity/Restlessness* 6 %), while the scale *Impulsivity/Emotional Lability* did not significantly contribute to the explanation of variance in the data. The high correlation of the *ADHD-Index* with the discriminant function indicates its suitability for measuring inattentive, hyperactive, and impulsive behaviors - the three core ADHD symptoms. It is important to note that the *ADHD-Index* shares some items with the scales *Hyperactivity/Restlessness* and *Impulsivity/Emotional Lability.* The contribution of items specific to these latter scales however, is low to almost non-existent, though. On the other hand, items specific for the *Inattention/Memory* and *Problems with Self-Concept* scales still contribute strongly to the

discriminant function. Those scales seem to be suited best for discriminating patients with ADHD from patients with other disorders associated with deficits in impulse-control. This was to be expected, since those disorders are not specifically associated with attention/memory problems and of all examined groups in this study only obese patients displayed problems with low self-concept.

Altogether, either predicting group membership through the use of discriminant analysis or the use of the German CAARS norm tables resulted in satisfactory sensitivity and specificity parameters. When using the *ADHD-Index* together with the CAARS norm tables, splitting the sample according to the inconsistency-indexincreases both the sensitivity as well as the specificity values. The accuracy rating is highest (82.5%), when the cut-off is set two standard deviations off the mean.

Limitations

Subjects in the online sample were not diagnosed by clinicians, but were assigned to the ADHD or control group solely based on their response to the question if they had a diagnosis of ADHD. However, there were no substantial differences when comparing the scores of the ADHD subjects diagnosed by a professional clinician to those of the online sample assigned to the ADHD-group. The same applies for the control group. Furthermore, considering the similarities within both groups and the large differences between the groups (ADHD and controls), it seems safe to assume that the online sample is of a fair quality, especially since the online data was carefully examined and forms with obviously random or one-sided response tendencies have been removed from the sample.

Another limitation is that co-morbidities of the ADHD-group were not taken into account. We might have had patients within this group that were also obese, pathological shoppers or problem/pathological gamblers. Since patients with ADHD are frequently affected by at least one other disorder (Kessler et al., 2006; Kooij et al., 2010; Sobanski et al., 2006), chances that this sample is not biased are slim at best. On the other hand, considering that ADHD is a disorder with frequent and various co-morbidities, the usefulness of a “pure” sample, regarding the application of the CAARS in everyday clinical practice, is questionable. If anything, a contaminated ADHD-sample, due to overlapping co-morbidities in all clinical groups, likely results in smaller differences. Similarly, the presence of ADHD was not an exclusion criterion for the group with extreme obesity and for patients with pathological

buying or problem gambling. Those groups were not screened for ADHD. Given that the literature indicates high psychiatric comorbidity in these groups including ADHD (Gruss et al., 2012; Black et al., 2012), the present findings might have been biased by possible ADHD symptoms in these control groups.This makes distinction of groups more complicated, which indicates the superior quality of the CAARS to differentiate clinical groups, since there are substantial differences between the patients with ADHD and all other groups.

The absence of a group of subjects diagnosed with emotionally unstable personality disorder (impulsive or borderline type) is a limitation, as, beyond lack of behavioral inhibition, those share additional clinical features (e. g. emotional dysregulation and cognitive impairment) with patients with ADHD, and therefore constitute the group of patients most difficult to distinguish (Philippsen, 2006).

Conclusion

All things considered it can be said, that the short version of the German adaptation of the CAARS differentiates well between groups of patients with ADHD and groups with other primary diagnoses related to poor impulse control, especially those based on regulation of aversive emotional states using dysfunctional behaviors or substances. Across all scales and groups, mean value differences are consistently high. Sensitivity and specificity parameters are adequate, whether classification of group membership is based on discriminant analysis or based on manual cut-offs. Especially the *ADHD-Index* consisting of twelve items that can be calculated when using any form of the CAARS (long, short or screening), has a strong predicting power whether a subject has ADHD or another disorder related to impulse control problems. Its accuracy rating is highest (82.5 %), when the cut-off is set two standard deviations off the mean, relative to the German norm sample. This is important, since there have been some reports that the CAARS is capable of differentiating patients with ADHD from a healthy control sample, but lacks the ability to differentiate ADHD from other disorders. The heterogeneity of its items - representing the diversity of ADHD-core symptoms - seems to be the main strength of the *ADHD-Index*, as it remains robust to distortion even while individual items resemble symptoms of other psychiatric disorders.

Conflict of Interest: The authors have no conflicts of interest to declare.

References:

American Psychiatric Association (2000). Diagnostic and statistical manual of mental disorders (4th ed., rev.). *DOI:10.1176/appi.books.9780890423349.*

American Psychiatric Association. (2013). Cautionary statement for forensic use of *DSM-5.* In *Diagnostic and statistical manual of mental disorders* (5th ed.). doi:10.1176/appi.books.9780890425596.744053

Barkley, R.A., Brown, T. E. (2008). Unrecognized Attention-Deficit/Hyperactivity Disorder in Adults Presenting with Other Psychiatric Disorders.*CNS Spectrums, 13, pp 977-984, DOI:10.1017/S1092852900014036*

Bell, A. S. (2010). A Critical Review of ADHD Diagnostic Criteria: What to Address in the DSM-V.*Journal of Attention Disorders 15 (1), pp. 3–10. DOI: 10.1177/1087054710365982*.

Biederman, J., Mick, E., Faraone, S. V. (2000). Age-dependent decline of symptoms of attention deficit hyperactivity disorder: impact of remission definition and symptom type. *American journal of psychiatry, 157(5), 816-818.*

Bischof A., Meyer C., Bischof, G., Kastirke N., John U., Rumpf, H.-J. (2013). Comorbid Axis I-disorders among subjects with pathological, problem, or at-risk gambling recruited from the general population in Germany: Results of the PAGE study. *Psychiatry Research*, *210*(3), 1065-1070.

Black, D. W., Shaw, M., McCormick, B., Bayless, J. D., Allen, J. (2012). Neuropsychological performance, impulsivity, ADHD symptoms, and novelty seeking in compulsive buying disorder. *In Psychiatry Research 200 (2–3), pp. 581–587.* DOI: 10.1016/j.psychres.2012.06.003.

Bonato, D. P., Boland, F. J. (1983). Delay of gratification in obese children. *Addictive Behaviors* 8 (1), pp. 71–74. DOI: 10.1016/0306-4603(83)90059-X.

Breyer, J., Botzet, A. M., Winters, K. C., Stinchfield, R. D., August, G., Realmuto, G. (2009). Young Adult Gambling Behaviors and their Relationship with the Persistence of ADHD. *Journal of Gambling Studies. In J Gambl Stud 25 (2), pp. 227–238.* DOI: 10.1007/s10899-009-9126-z.

Carlton, P. L., Manowitz, P. (1992). Behavioral Restraint and Symptoms of Attention Deficit Disorder in Alcoholics and Pathological Gamblers. *Neuropsychobiology* 25 (1), pp. 44–48.

Christiansen, H., Hirsch, O., Abdel-Hamid, M. & Kis, B. (2014). *CAARS: Deutsche Adaptation der Conners Adult ADHD Rating Scales (CAARS)*.

Christiansen, H., Kis, B., Hirsch, O., Matthies, S., Hebebrand, J., Uekermann, J. (2012). German validation of the Conners Adult ADHD Rating Scales (CAARS) II: Reliability, validity, diagnostic

sensitivity and specificity. *European Psychiatry* 27 (5), pp. 321–328. DOI: 10.1016/j.eurpsy.2010.12.010.

Christiansen, H., Kis, B., Hirsch, O., Philipsen, A., Henneck, M., Panczuk, A. (2011). German validation of the Conners Adult ADHD Rating Scales–self-report (CAARS-S) I: Factor structure and normative data. *European Psychiatry 26 (2), pp. 100–107*. DOI: 10.1016/j.eurpsy.2009.12.024.

Cohen, J. (1988).*Statistical Power Analysis for the Behavioral Sciences, 2nd Edition.*Hillsdale, N.J.: Lawrence Erlbaum.

Conners, C. K., Erhardt, D., Sparrow, E. (1999). *Conner's adult ADHD rating scales (CAARS) technical manual.* Multi-Health System.

Cortese, S., Peñalver, C. M. (2010). Comorbidity between ADHD and Obesity: Exploring Shared Mechanisms and Clinical Implications. *Postgraduate Medicine 122 (5), pp. 88–96.* DOI: 10.3810/pgm.2010.09.2205.

Cumyn, L., Kolar, D., Keller, A., Hechtman, L. (2007). Current issues and trends in the diagnosis and treatment of adults with ADHD. Expert Review of Neurotherapeutics. *Expert Review of Neurotherapeutics*7 (10), *pp. 1375–1390.* DOI: 10.1586/14737175.7.10.1375.

Davidson, M. A. (2007). ADHD in Adults: A Review of the Literature. *Journal of Attention Disorders* 11 (6), pp. 628–641. DOI: 10.1177/1087054707310878.

DeZwaan, M., Gruß, B., Müller, A., Philipsen, A., Graap, H., Martin, A., Hilbert, A. (2011). Association between obesity and adult attention-deficit/hyperactivity disorder in a German community-based sample.*Obesity Facts, 4(3), 204-211.*

Edebol, H., Helldin, L., Norlander, T. (2012): Measuring adult Attention Deficit Hyperactivity Disorder using the Quantified Behavior Test Plus. *Psych Journal* 2 (1), pp. 48–62. DOI: 10.1002/pchj.17.

Edvinsson, D., Lindstrom, E., Bingefors, K., Lewander, T., Ekselius, L. (2013). Gender differences of axis I and II comorbidity in subjects diagnosed with attention-deficit hyperactivity disorder as adults. *Acta neuropsychiatrica* 25 (3), pp. 165–174. DOI: 10.1111/j.1601-5215.2012.00682.x.

First, M.B., Spitzer, R. L., Gibbon, M., Williams, J.B.W. (2002). Structured clinical interview for DSM-IV-TR axis I disorders, research version (SCID-I-RV). *New York: Biometrics Research, New York State Psychiatric Institute.*

Fisher, C.D. (1993). Boredom at work: A neglected concept. *Human Relations **46** (3): 395–417.*

Franklin, J., Denyer, G., Steinbeck, K. S., Caterson, I. D., Hill, A. J. (2006). Obesity and Risk of Low Self-esteem: A Statewide Survey of Australian Children Pediatrics. *118 (6) 2481-2487.* DOI:10.1542/peds.2006-0511

Georgiadou, E., Gruner-Labitzke, K., Köhler, H., de Zwaan, M., Müller, A. (2014). Cognitive function and food-unspecific impulsivity in post bariatric surgery patients. *Frontiers in Psychology, 5, 1502*.

Gerlach, G., Herpertz, S., Löber, S. (2015).Personality traits and obesity: a systematic review. *Obesity Reviews, 16(1), 32-63*.

Gruss, B., Müller, A., Horbach, T., Martin, A., de Zwaan, M. (2012). Attention-deficit/hyperactivity disorder (ADHD) in a pre-bariatric surgery sample. *European Eating Disorder Review, 20(19), e103-e107*.

Hervey, A. S., Epstein, J. N., Curry, J. F. (2004). Neuropsychology of Adults with Attention-Deficit/Hyperactivity Disorder: A Meta-Analytic Review. *Neuropsychology 18 (3), pp. 485–503*. DOI: 10.1037/0894-4105.18.3.485.

Hirsch, O. & Christiansen, H. (2016). Factorial structure and validity of the Quantified Behavior Test Plus (Qb+©). *Assessment*. DOI: 10.1177/1073191116638426

Hirsch, O., Hauschild, F., Schmidt, M. H., Baum, E., Christiansen, H. (2013): Comparison of Web-Based and Paper-Based Administration of ADHD Questionnaires for Adults. *J Med Internet Res 15 (3),pp. e47*. DOI: 10.2196/jmir.2225.

Kessler, R. C., Adler, L., Barkley, R., Biederman, J., Conners, C. K., Demler, O. (2006). The Prevalence and Correlates of Adult ADHD in the United States: Results from the National Comorbidity Survey Replication. *AJP* 163 (4), pp. 716–723. DOI: 10.1176/ajp.2006.163.4.716.

Kling, K. C., Hyde, J. S., Showers, C. J., Buswell, B. N. (1999). Gender differences in self-esteem: a meta-analysis. *Psychological bulletin*, *125*(4), 470.

Kooij, S. J. J., Bejerot, S., Blackwell, A., Caci, H., Casas-Brugué, M., Carpentier, P. J. (2010). European consensus statement on diagnosis and treatment of adult ADHD: The European Network Adult ADHD. *BMC Psychiatry* 10 (1), p. 67. DOI: 10.1186/1471-244X-10-67.

Levy, Florence (1991). The Dopamine Theory of Attention Deficit Hyperactivity Disorder (ADHD). *Australian and New Zealand Journal of Psychiatry Vol. 25*, Iss. 2.

McCann, B. S., Roy-Byrne, P. (2004). Screening and diagnostic utility of self-report attention deficit hyperactivity disorder scales in adults. *Comprehensive Psychiatry* 45 (3), pp. 175–183. DOI: 10.1016/j.comppsych.2004.02.006.

McElroy, S. L., Keck, P. E., Pope, H. G., Smith, J. M., Strakowski, S. M. (1994). Compulsive buying: a report of 20 cases. *The Journal of clinical psychiatry*, *55*(6), 242-248.

Meyer C., Bischof, A., Westram, A., Jeske, C., de Brito, S., Glorius, S., Schön, D., Porz, S., Gürtler, D., Kastirke, N., Hayer, T., Jacobi, F., Lucht, M., Premper, V., Gilberg, R., Hess D., Bischof, G., John, U.,

Rumpf, H.-J. (2015). The "Pathological Gambling and Epidemiology" (PAGE) study program: Design and Fieldwork. *International Journal of Methods in Psychiatric Research 24: 11-31.*

Miller, T. W.,Nigg, J. T., Faraone, S. V. (2007). Axis I and II comorbidity in adults with ADHD. *Journal of Abnormal Psychology* 116 (3), pp. 519–528. DOI: 10.1037/0021-843X.116.3.519.

Mobbs, O., Crépin, C., Thiéry, C., Golay, A., van der Linden, M. (2010): Obesity and the four facets of impulsivity. Changing obesity: Theories, facts and interventions.In *Patient Education and Counseling* 79 (3), pp. 372–377. DOI: 10.1016/j.pec.2010.03.003.

Müller, A., Mitchell, J. E., de Zwaan, M. (2015). Compulsive buying. *The American Journal on Addictions, 24(2):*132-137.

Müller, A., Mühlhans, B., Silbermann, A., Müller, U., Mertens, C., Horbach, T., de Zwaan, M. (2009). Pathologisches Kaufen und psychische Komorbidität. *PPmP-Psychotherapie· Psychosomatik· Medizinische Psychologie*, *59*(08), 291-299.

Nederkoorn, C., Braet, C., van Eijs, Y., Tanghe, A., Jansen, A. (2006).Why obese children cannot resist food: The role of impulsivity. *Eating Behaviors* 7 (4), pp. 315–322. DOI: 10.1016/j.eatbeh.2005.11.005.

O'Dea, J. A. (2006). Self-concept, Self-esteem and Body Weight in Adolescent Females: A Three-year Longitudinal Study. *J Health Psychol July 2006 11: 599-611.*

Ohlmeier, M.D., Peters, K., Kordon, A., Seifert, J., Te Wildt, B., Wiese, B., Ziegenbein, M., Emrich, H., M., Schneider, U. (2007). Nicotine and alcohol dependence in patients with comorbid attention-deficit/hyperactivity disorder (ADHD).*Alcohol & Alcoholism, 42(6).*

Pagoto, S. L., Curtin, C., Lemon, S. C., Bandini, L. G., Schneider, K. L., Bodenlos, J. S., Ma, Y. (2009).Association between Adult Attention Deficit/Hyperactivity Disorder and Obesity in the US Population. *Obesity* 17 (3), pp. 539–544. DOI: 10.1038/oby.2008.587.

Philipsen, A. (2006): Differential diagnosis and comorbidity of attention-deficit/hyperactivity disorder (ADHD) and borderline personality disorder (BPD) in adults. *Eur Arch Psychiatry ClinNeurosci*256 (1), pp. i42-i46. DOI: 10.1007/s00406-006-1006-2.

Polanczyk, G.,de Lima, M. S., Horta, B. L., Biederman, J., Rohde, L. A. (2007).The Worldwide Prevalence of ADHD: A Systematic Review and Metaregression Analysis. *AJP* 164 (6), pp. 942–948. DOI: 10.1176/ajp.2007.164.6.942.

Riccio, C. A., Reynolds, C. R. (2001). Continuous Performance Tests Are Sensitive to ADHD in Adults but Lack Specificity. *Annals of the New York Academy of Sciences* 931 (1), pp. 113–139. DOI: 10.1111/j.1749-6632.2001.tb05776.x.

Schoechlin, C., Engel, R. R. (2005).Neuropsychological performance in adult attention-deficit hyperactivity disorder: Meta-analysis of empirical data. *Archives of Clinical Neuropsychology* 20 (6), pp. 727–744. DOI: 10.1016/j.acn.2005.04.005.

Simon, V., Czobor, P., Bálint, S., Mészáros, Á., Bitter, I. (2009). Prevalence and correlates of adult attention-deficit hyperactivity disorder: meta-analysis. *The British Journal of Psychiatry* 194 (3), pp. 204–211. DOI: 10.1192/bjp.bp.107.048827.

Sobanski, E. (2006). Psychiatric comorbidity in adults with attention-deficit/hyperactivity disorder (ADHD). *Eur Arch Psychiatry ClinNeurosci* 256 (1), pp. i26-i31. DOI: 10.1007/s00406-006-1004-4.

Solanto, M. V., Etefia, K., Marks, D. J. (2004).The Utility of Self-Report Measures and the Continuous Performance Test in the Diagnosis of ADHD in Adults. *CNS Spectrums, 9,* pp 649-659 doi:10.1017/S1092852900001929

Specker, S. M., Carlson, G. A.,Christenson, G. A., Marcotte, M. (1995). Impulse Control Disorders and Attention Deficit Disorder in Pathological Gamblers. *Annals of Clinical Psychiatry* 7 (4), pp. 175–179. DOI: 10.3109/10401239509149623.

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin, Vol 128(5), Sep 2002, 825-848.* http://dx.doi.org/10.1037/0033-2909.128.5.825

van Emmerik-van Oortmerssen, K., van de Glind, G., Koeter, M. W. J., Allsop, S., Auriacombe, M., Barta, C.(2014).Psychiatric comorbidity in treatment-seeking substance use disorder patients with and without attention deficit hyperactivity disorder: results of the IASP study. *Addiction* 109 (2), pp. 262–272. DOI: 10.1111/add.12370.

van Voorhees, E. E., Hardy, K. K., Kollins, S. H. (2011). Reliability and Validity of Self- and Other-Ratings of Symptoms of ADHD in Adults. *Journal of Attention Disorders* 15 (3), pp. 224–234. DOI: 10.1177/1087054709356163.

Wilens, T., Adamson, J., Whitley, J., Santry, A., Monuteaux, M., Biederman, J. (2007). Do individuals with ADHD self-medicate with cigarettes and substances of abuse? Results from a controlled family study of ADHD. *Am J Addict., 16Suppl 1:14-21, quiz 22-3*

World Health Organization (WHO) (2009). The World Mental Health Survey Initiative. Computer Assisted Personal Interview (CAPI V21.1.1). Gambling section. Retrieved December 31, 2013, from http://www.hcp.med.harvard.edu/wmhcidi/instrumentscapi.php

Table 1: Demographics with number of participants, gender and mean age with standard deviation for the different groups

Group	n	% of total	male	female	age (SD)
ADHD	123	8.6	66 (53.7%)	57 (46.3%)	31,49 (9.75)
Control Group	592	41.4	227 (38.3%)	365 (61.7%)	34,18 (12.59)
Obesity	135	9.4	41 (30.4%)	94 (69.6%)	39,87 (16.61)
Buying	62	4.3	12 (19.4%)	50 (80.6%)	40,35 (10.75)
Gambling	517	36.2	417 (80.7%)	100 (19.3%)	41,24 (12.09)
TOTAL	1429	100.0	763 (53.4%)	666 (46.6%)	37,31 (12.56)

Table 2: All Items (paraphrased) used in the CAARS short form. Items in **Bold** letters are also part of the subscale ADHD-Index, which consists of 12 items. The number on the right refers to the number in the CAARS-Manual.

No.	Subscale	Item
	Inattention/Memory Problems	
1	Problems with organizing oneself	3
2	... keeping track on several tasks	5
3	**... finishing tasks**	**17**
4	... procrastination	18
5	... keeping focus	21
	Hyperactivity/Restlessness	
6	Problems with constantly moving	4
7	... being bored easily	6
8	... sensation-seeking	10
9	**... feelings of inner unrest**	**11**
10	... fidgetiness	23
	Impulsivity/Emotional Lability	
11	Problems with interrupting people	4
12	**... controlling temper**	**7**
13	**... angry outbursts**	**8**
14	... irritability	13
15	... capriciousness	20
	Problems with Self-Concept	
16	**Problems with self efficacy**	**9**
17	... self-reproach	15
18	... faking self-confidence	16
19	... lack of confidence	25
20	**... learning experience**	**26**
	ADHD-Index	
21	**Problems with restlessness**	**2**
22	**... distractibility**	**12**
23	**... being a low performer**	**14**
24	**... intruding in others activities**	**19**
25	**... hyper-focus**	**22**
26	**... keeping focus on boring activities**	**24**

Table 3: Results of MANCOVA for the different groups and CAARS subscales adjusted for age and gender with Mean Difference (MD), Standard Error (SE), and effect size (d)

	Group	Comparison	MD	SE	sig.	d
ADHD-Index	ADHD	Control Group	0.99	.05	**.000***	**1.92**
		Obesity	0.91	.07	**.000***	**1.86**
		Buying	0.94	.08	**.000***	**1.87**
		Gambling	0.85	.05	**.000***	**1.68**
	Obesity	Control Group	0.08	.05	1.00	0.10
		Buying	0.04	.08	1.00	0.06
		Gambling	-0.06	.05	1.00	0.09
	Buying	Control Group	0.04	.07	1.00	0.04
		Gambling	-0.10	.07	1.00	0.15
	Gambling	Control Group	0.14	.04	**.001***	**0.18**
Inattention/Memory Problems	ADHD	Control Group	1.11	.06	**.000***	**1.67**
		Obesity	1.09	.08	**.000***	**1.72**
		Buying	1.26	.10	**.000***	**2.06**
		Gambling	1.04	.07	**.000***	**1.61**
	Obesity	Control Group	0.02	.06	1.00	0.02
		Buying	0.16	.10	.950	0.29
		Gambling	-0.05	.07	1.00	0.11
	Buying	Control Group	-0.14	.09	.942	0.30
		Gambling	-0.23	.09	.148	0.15
	Gambling	Control Group	0.07	.04	.879	0.09
Hyperactivity/Restlessness	ADHD	Control Group	1.01	.06	**.000***	**1.66**
		Obesity	1.51	.08	**.000***	**1.80**
		Buying	0.92	.09	**.000***	**1.54**
		Gambling	0.78	.06	**.000***	**1.28**
	Obesity	Control Group	-0.04	.06	1.00	0.13
		Buying	-0.13	.09	1.00	0.21
		Gambling	-0.27	.06	**.000***	**0.46**
	Buying	Control Group	0.93	.08	1.00	0.09
		Gambling	-0.14	.08	.785	0.25
	Gambling	Control Group	0.24	.04	**.000***	**0.34**
Impulsivity/Emotional Lability	ADHD	Control Group	0.92	.06	**.000***	**1.63**
		Obesity	0.86	.07	**.000***	**1.58**
		Buying	0.77	.09	**.000***	**1.40**
		Gambling	0.74	.06	**.000***	**1.42**
	Obesity	Control Group	0.06	.06	1.00	0.07
		Buying	-0.09	.09	1.00	0.16
		Gambling	-0.13	.06	.274	0.23
	Buying	Control Group	0.15	.08	.479	0.27
		Gambling	-0.04	.08	1.00	0.02
	Gambling	Control Group	0.19	.04	**.000***	**0.34**
Problems with Self-Concept	ADHD	Control Group	0.77	.07	**.000***	**1.05**
		Obesity	0.42	.09	**.000***	**0.52**
		Buying	0.74	.17	**.000***	**0.88**
		Gambling	0.73	.08	**.000***	**1.09**
	Obesity	Control Group	0.35	.07	**.000***	**0.45**
		Buying	0.31	.11	.055	0.36
		Gambling	0.31	.74	**.000***	**0.52**
	Buying	Control Group	0.04	.10	1.00	0.05
		Gambling	-0.01	.10	1.00	0.14
	Gambling	Control Group	0.04	.05	1.00	0.10

Table 4: Standardized canonical discriminant function coefficients (SCDFC) and Structure Matrix of the discriminant analysis for the different groups

CAARS-Subscale	SCDFC	Structure Matrix
ADHD-Index	.631	.917
Inattention/Memory	.452	.874
Self-Concept	-.339	.499
Hyperactivity/Restlessness	.243	.805
Impulsivity/Emotional Lability	not included in analyses	

Table 5.1: Sensitivity and Specificity using ADHD-Index for predicting group-membership, based on discriminant analysis

		Diagnosis		
		Positive	negative	
CAARS-Result	positive	98 (0.80*)	195 (0.20)	239
	negative	25 (0.15)	1111 (0.85**)	1136
		123	1306	1429

5.2: Sensitivity and Specificity using ADHD-Index for predicting group-membership, based on German CAARS-Norm Tables

		ADHD-Diagnosis		
		Positive	negative	
Index > 84 % (1 SD)	positive	110 (0.89*)	413 (0.32)	523
	negative	13 (0.11)	893 (0.68**)	906
		123	1306	1429
Index > 98 % (2 SD)	positive	93 (0.76*)	210 (0.16)	303
	negative	30 (0.24)	1096 (0.84**)	1126
		123	1306	1429

5.3: Sensitivity and Specificity using ADHD-Index for predicting group-membership, based on German CAARS-Norm Tables, sample adjusted by Inconsistency-Index

		ADHD-Diagnosis		
		Positive	negative	
Index >84 % (1 SD)	positive	89 (0.89*)	307 (0.27)	396
	negative	11 (0.11)	827 (0.73**)	838
		100	1134	1234
Index >98 % (2 SD)	positive	78 (0.78*)	151 (0.13)	229
	negative	22 (0.22)	983 (0.87**)	1005
		100	1134	1234

Articles

Behavioral Assessment of Core ADHD Symptoms Using the QbTest

Journal of Attention Disorders
XX(X) 1–12

DOI: 10.1177/1087054712472981
http://jad.sagepub.com

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Abstract

Objective: Hyperactivity, one of the core symptoms of ADHD, has been mostly neglected in neuropsychological assessment of childhood ADHD. The neuropsychological Quantified behavior Test (QbTest) separately assesses all three core symptoms of ADHD on a behavioral level. Factor structure of the QbTest and its concurrent and discriminant validity are presented. **Method:** An exploratory factor analysis (n = 828 children) was performed. In a second sample (n = 102 children) a Multi-Trait-Multi-Method (MTMM) approach was used for validity analyses. **Results:** A three factorial model explained 76 % of the total variance, with the resulting QbTest factors significantly influenced by age and gender. The MTMM approach yielded promising results for discriminant, yet inconsistent findings for concurrent validity between the QbTest and another attention test as well as for Conners' Parent and Teacher Rating Scales. **Conclusion:** Results indicate that the QbTest may be helpful for the behavioral assessment of childhood ADHD, yet further studies on its psychometric quality and clinical utility are needed. *(J. of Att. Dis. 2012; XX(X) 1-XX)*

Keywords

ADHD, assessment, continuous performance test (CPT), Quantified behavior Test (QbTest)

Introduction

There is a lack of well-validated, objective, and easy-to-administer tests that separately assess all three core symptoms of ADHD (i.e., age-inadequate levels of inattention, hyperactivity, and impulsiveness), one of the most common and highly impairing childhood disorders (Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007; Stein, Blum, & Barbaresi, 2011). During the past decades, guidelines for the assessment and diagnosis of ADHD have been developed (e.g., American Academy of Child & Adolescent Psychiatry, 2007; American Academy of Pediatrics, 2000; Taylor et al., 2004). They all recommend the use of a variety of methods and informational sources, including child behavior observation, parent and teacher rating scales, standardized clinical interviews for parents and children, and physical examinations. Although these sources play an important role in the diagnosis of ADHD, they have been criticized because of their subjective nature. Self-report and observer-rating scales as well as clinical interviews are vulnerable to both clinician and informant biases (Edwards et al., 2007). Moreover, findings of reduced reliability for monitoring symptoms over time (Rabiner et al., 2010) and influences of children's gender, ethnicity, and socioeconomic status (SES) on symptom ratings (Bussing et al., 2008) have further supported objections against rating scale procedures. Therefore, objective and reliable laboratory-based measures of ADHD symptoms are highly desirable, and considerable effort has been put into the development and evaluation of more direct assessment methods of core ADHD symptoms.

Over the past 20 years, computer-administered neuropsychological attention tests have become a popular means for behavioral assessment of attention processes, providing a direct observational, norm-referenced measure (Hasson & Fine, 2012). The continuous performance test (CPT) is the most commonly used neuropsychological test for ADHD evaluation in both research and clinical settings (Ballard, 1996; Corkum & Siegel, 1993; Epstein et al., 2003; McGee, Clark, & Symons, 2000; Nichols & Waschbusch, 2004; Riccio, Waldrop, Reynolds, & Lowe, 2001). The CPT is a computer-based vigilance test that aims at assessing

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executive functions (EFs) like sustained attention as well as selective attention processes and behavioral inhibition. These EFs have been shown to be closely related to symptoms of ADHD (for a review, see Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). When performing a CPT, participants are generally requested to react as fast as possible to target stimuli by pressing a key and to refrain from pressing it for nontarget stimuli. Failure to respond to the target stimuli is usually interpreted as a result of inattention, while responses to nontarget stimuli are interpreted as results of impulsivity. It is important to note that the term *CPT* in fact refers to a test paradigm, with many different versions that vary in duration from 6 to 22 min, target-to-nontarget ratio, and other test features (Riccio et al., 2001).

Although CPTs have excellent face validity and a great intuitive appeal as an objective measure for ADHD symptoms, research concerning the diagnostic utility of CPTs for ADHD remains controversial (Barkley, 1991; Halperin et al., 1990; McGee et al., 2000). While a large number of studies have reported differences in CPT performance measures between ADHD children and healthy controls (for a review, see Nichols & Waschbusch, 2004), only few have been successful in finding those differences for ADHD children and other clinical groups (O'Brien et al., 1992). Forbes (1998) stated that a diagnostic instrument must be able to distinguish between clinical groups to be of clinical utility. As it is true for behavior rating scales, interviews, standardized observation methods, or any other diagnostic tool, CPTs by themselves up to today have not been shown to have sufficient discriminative validity to determine a diagnosis of ADHD. There is agreement on the fact, though, that the use of CPTs as part of a larger neuropsychological battery can improve diagnostic precision and may be highly important for the reduction of gender bias in the diagnostic process (Hasson & Fine, 2012). Moreover, CPTs provide a quick and relatively cost-effective laboratory-based measure with the potential of being suitable for medication monitoring (Gualtieri & Johnson, 2005; Riccio et al., 2001; Wehmeier, Dittmann, Banaschewski, & Schacht, 2012; Wehmeier et al., 2011).

The Quantified behavior Test (QbTest©; see description below) is a commercial neuropsychological test that combines the CPT paradigm with apparative measurement of motor activity (for similar measurement techniques, see Teicher, Ito, Glod, & Barber, 1996) and aims at assessing all three core ADHD symptoms (i.e., inattention, hyperactivity, and impulsivity) separately. Two different QbTest versions are provided targeting two different age groups. The first version can be used for children aged 6 to 12, and the second version can be applied for participants aged 12 to 60. As described above, standard CPTs appear to have an insufficient ability to discriminate between ADHD and other clinical conditions. Thus, additional use of motor assessment might enhance test validity because hyperactivity is a core symptom in many ADHD children and has been frequently neglected in neuropsychological attention tests so far. In addition, the QbTest may be helpful in reducing gender, age, and SES biases in the diagnostic process, which are often observed when applying rating scale measures, as described above.

Despite these potential advantages, neither the factorial validity (i.e., "Does the test capture the three core ADHD symptoms?") nor its convergent validity with other measures (i.e., "Do the QbTest results correlate with corresponding questionnaire measures?") has been investigated. This is particularly noteworthy, as the QbTest (6-12)[1] is being marketed and widely used as a diagnostic tool for ADHD (Vogt & Williams, 2011) and even for titration of stimulant medication by a growing number of practitioners in European and North American countries (Wehmeier et al., 2011; Wehmeier et al., 2012). Moreover, the test has been incorporated in numerous studies concerning different aspects of ADHD (Brocki, Tillman, & Bohlin, 2008; Günther, poster presentation; Oades, Dauvermann, Schimmelmann, Schwarz, & Myint, 2010; Scholtens, Diamantopoulou, Tillman, & Rydell, 2011; Vogt & Williams, 2011; Wehmeier et al., 2011; Wehmeier et al., 2012). As the factorial validity of the test has not yet been investigated, it remains unclear how the different QbTest variables (a total of 17) relate to one another and whether they reflect ADHD symptoms in children. Reporting and using a large number of measures is problematic because it will lead to an increase of Type I error (false positive, that is, risk of diagnosing a healthy child with ADHD) since repeated measurement of the same latent construct dramatically decreases the threshold for a significant finding. Using standard corrections to control for the many measures (e.g., Bonferroni correction) would lead to higher risk of committing a Type II error though (false negative, that is, risk of overlooking a child who does in fact have ADHD and could profit from adequate treatment) because it drastically raises the threshold for a significant finding. These methodological problems could be attenuated by integrating variables that presumably measure the same latent constructs with single factors.

Besides the methodological issues, reporting a multitude of measures is highly inefficient for clinical practice. For practitioners, it is much more convenient to have few main parameters to consider and interpret than to observe 10 or more variables from one single test. This is especially true for diagnoses in ADHD where already a multitude of different informational sources and measures must be applied and integrated (see Taylor et al., 2004).

Factor analysis (FA) is the methodological procedure of grouping variables together and reducing redundant information by producing factor scores that are easier to interpret and thus a major benefit for practitioners. The primary aim of this study, therefore, is to explore the factorial structure of the QbTest and its conceptual accordance with core ADHD symptoms.

In addition to the open question regarding factorial validity, it is unknown whether the symptom dimensions measured with the QbTest overlap with questionnaire-based measures. Particularly, it is unknown whether the specific measurement of motor activity as assessed with the motion-tracking system incorporated in the QbTest is related to parent or teacher ratings of hyperactive behavior. The secondary aim of the study, therefore, is to examine the concurrent and divergent validity of the evolving QbTest factors.

Method

Procedure and Participants

Two separate samples were used to (a) analyze the structure of the QbTest (Sample I) and (b) analyze concurrent and discriminant validity of the evolving factors (Sample II). Sample I consisted of 901 German children who were referred to a practice for Child and Adolescent Psychiatry and Psychotherapy for ADHD assessment. Assessment was based on diagnostic standards as formulated in the guidelines (see Taylor et al., 2004). Clinical and psychological assessments were performed by a multiprofessional team. As part of the assessment process, children also completed the QbTest. As Sample I consisted of convenience sampling in the private pediatric practice, some children who were presented in the practice had been previously examined for ADHD symptoms elsewhere. Irrespective of preexisting diagnostic results though, all children had to complete routine assessment to assure well-founded diagnosis. Children who received ADHD-specific medication were off medication for at least 24 hr prior to performing the QbTest. Assessment took place in the practice and was either performed by a senior physician (LL) or by well-trained medical staff. All children received pharmacological and/or psychological treatment after ADHD diagnosis was confirmed.

Sample II consisted of 102 strictly diagnosed German ADHD children who were diagnosed and treated for ADHD at the University Hospital of Child and Adolescent Psychiatry, Essen, and at the Department of Clinical Psychology and Psychotherapy at the University of Marburg. A standardized *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association [APA], 2000)–based clinical interview with the parents (Parental Account of Childhood Symptoms [PACS]; Chen & Taylor, 2006; Delmo, Weiffenbach, Gabriel, Stadler, & Poustka, 2000/2001) and the Conners' third Parent and Teacher Rating Scales (Conners, 2008), intelligence testing (Wechsler Intelligence Scale for Children–Fourth edition [WISC-IV], German version; Petermann & Wechsler, 2011; Sattler, 1992), and the QbTest were part of routine assessment. Part of Sample II (n = 32) additionally completed another laboratory test for attention assessment, the children's test battery of attention assessment, with the subtests sustained attention, Go/No-Go, and divided attention (KITAP; Zimmermann, Gondan, & Fimm, 2002). Assessment was performed by well-trained medical staff, and again, all children received pharmacological and/or psychological treatment after ADHD diagnosis was confirmed.

Study protocols in accordance with the criteria of the Declaration of Helsinki were reviewed and approved by the local institutional review boards. Informed consent was obtained from all parents or guardians and children prior to the assessment, and their confidentiality was assured.

Deletion of univariate outliers in Sample I (3 *SD*s above mean in any of the relevant QbTest variables) left 829 cases for analysis. Because only one person with an age of 12 was available in the data set, this case was also excluded from further analysis for homogeneity of the sample. The final Sample I thus consisted of 828 cases: 588 males (M age = 8.5 years, SD = 1.6 years) and 240 females (M age = 8.5 years, SD = 1.5 years). According to Comrey and Lee (1992), this sample size is very good to excellent for exploratory factor analysis (EFA). Distribution of age and gender in the remaining sample did not significantly differ from the total sample. The gender distribution reflects the frequently reported distribution of gender in ADHD, with boys outnumbering girls about 3 to 1 (APA, 2000). Sample II consisted of 102 cases: 79 males (M age = 8.9 years, SD = 1.7 years) and 23 females (M age = 9 years, SD = 1.5 years). Table 1 presents the distribution of age and gender in the final Sample I and in Sample II.

The Quantified Behavior Test for Children Aged 6 to 12 Years

The QbTest is a combined CPT and activity test for children aged 6 to 12 years (Ulberstad, 2012), which aims to assess all three core symptoms of ADHD in one test.[2] While performing a standardized CPT on a computer, the movements of the participant are recorded with an infrared camera following a reflective marker attached to a headband that the participant wears while performing the test. The infrared camera is placed about 1 m away from the participant, who is sitting in front of a computer screen. Participants are seated on a stool with no back support or armrest, to assure that they do not adopt a reclining posture. The QbTest CPT involves presentation of two different stimuli: a gray circle (target) and a gray circle with a cross (nontarget). The stimuli are presented on the screen for 100 ms per stimulus with an interstimulus interval (ISI) of 1,900 ms. The total number of stimuli presented in QbTest is 450 with an equal number of target and nontarget stimuli appearing in random order. Over the course of the test (15 min), participants are asked to press a button once in response to every target signal as fast as possible and to refrain from responding to nontargets. The test instructions thus emphasize both speed

Table 1. Frequency Distribution of Sample I and Sample II by Age and Gender

	Sample I						Sample II					
			Gender						Gender			
			Female		Male				Female		Male	
Age	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
6	110	13.3	27	3.2	83	10.0	6	5.8	0	0	6	5.8
7	146	17.6	46	5.6	100	12.1	15	14.7	3	2.9	12	11.8
8	153	18.5	41	5.0	112	13.5	26	25.5	6	5.9	20	19.6
9	172	20.8	59	7.1	113	13.6	18	17.7	7	6.8	11	10.8
10	140	16.9	42	5.1	98	11.8	17	16.7	3	2.9	14	13.7
11	107	12.9	25	3.0	82	9.9	11	10.8	2	1.9	9	8.8
12	0	0	0	0	0	0	9	8.8	2	1.9	7	6.8
Total	828	100	240	29.0	588	71.0	102	100	23	22.5	79	77.5

and accuracy. Participants' activities during the test are recorded by reading the coordinates (X and Y) of the headband marker. The position of the marker is sampled 50 times per second, with a spatial resolution of 1/27 mm per camera unit (Ulberstad, 2012). QbTech© provides separate norms for boys and for girls, as well as for all age groups included in QbTest 6-12 (age groups are per year, that is, separate norms for ages 6, 7, 8, 9, 10, 11, and 12). According to the test manual (Ulberstad, 2012), normative data from a control group of healthy children are based on a total of $n = 576$, including $n = 262$ males and $n = 314$ females.

The QbTest reports a total of 17 parameters. Those can be divided into activity and CPT measures. The reported activity measures include 5 parameters: (a) Time Active, which reflects the percentage of time the subject has moved more than 1 cm/s; (b) Distance, which reflects the distance traveled by the reflective headband marker and is measured in meters; (c) the score Area, measured as the surface covered by the headband reflector during the test and is presented in square centimeters; (d) Total Number of Microevents that are small movements of the reflective marker that occur when a position change since the last microevent is greater than 1 mm; and (e) Motion Simplicity, a measure of complexity of the motion pattern that is being reported in percentage.

Twelve CPT measures are reported, including (f) Reaction Time (RT) as the average time of all correct responses. This score indicates latency in information processing and motor response speed. (g) The score Outliers represents RTs that are very slow compared with the overall RT performance during the test. (h) RT Variation (RTVar) is calculated by the standard deviation of the mean of correct response times. It is a measure of the participant's inconsistency in response times. (i) The score Normalized Variation (NormVar) is the RTVar expressed in terms of RT. (j) The total number of missed targets is represented in the score Omission Errors, while the total number of false hits is depicted by (k) Commission Errors. (l) The score Normalized Commission Errors displays the proportion or ratio of commission errors to correct responses to the target stimulus. Too fast responses to a stimulus (less than 150 ms after presentation of the stimulus) are reported by the score (m) Anticipatory. When there is more than one button press per stimulus presentation, this is measured and reported by (n) Multiresponse. (o) D-Prime Modified (d′) is a measure of signal detectability. It reflects accuracy of target (signal) to nontarget (noise) discrimination and is calculated from commission and omission errors. (p) Longest Passivity is the maximum number of consecutive omission errors and gives information about the longest time the participant has been passive during the CPT. Finally, the total number of incorrect responses during the test is represented in the score (q) Error Rate that is calculated from commission errors plus omission errors divided by the total number of stimuli.

From all of the 17 above described QbTest parameters, 6 are secondary measures and measures of test involvement rather than providing direct performance information. Those secondary measures are calculated from performance information assessed by 1 of the 11 primary QbTest variables. Using those secondary variables for factor analysis would imply double counting the direct information contained in the primary variables. The secondary variables were thus excluded from further analyses (Variables 7, 9, 12, 15, 16, 17). Consequently, a total of 11 QbTest variables consisting of 5 activity measures and 6 CPT measures were included in the following analyses.

Statistical Analysis

Data reduction and analyses were carried out using the statistical package SPSS 19.0. Prior to analyses, all QbTest variables were examined for accuracy of data entry, missing

values, and outliers. No missing values were found, and outliers were identified as being 3 *SD*s above mean for each of the QbTest variables.

As a first step, a series of EFA were performed for data reduction and to obtain the factor structure of the test. Variables were included in the factor analysis if the following criteria were met: (a) variables loaded significantly (>.30) on at least one factor and (b) conceptual coherence was evident. In case of double loadings (>.30 on more than one factor), variables were attributed to the factor with the highest existing factor loading for this variable as well as when conceptual coherence was given. The scree test and the number of eigenvalues above 1.0 were used to select the number of factors for extraction. Because it is unlikely that the underlying dimensions are totally unrelated, we did not restrain our analyses to varimax rotation, but used oblique rotation ($\delta = 0$) instead. Also, each factor had to receive salient loadings (>.30) from more than one variable.

As a second step, Cronbach's α was computed to report internal consistency for the emerging factors. Finally, influences of age and gender on the QbTest factors were analyzed with a MANOVA. Effect sizes for differences between gender and age groups were reported when appropriate and interpreted according to Cohen (1977; small: $.01 \geq \eta^2$, medium: $.06 \geq \eta^2$, and large: $\eta^2 \geq .14$).

To further validate the QbTest, a multitrait–multimethod (MTMM) approach was used in Sample II, comparing the established factors (e.g., Hyperactivity, Inattention, Impulsivity) with the results of another test for attention assessment (KITAP; Zimmermann et al., 2002) and the Conners' third Parent and Teacher Rating Scales (Conners, 2008). Association of standardized KITAP results in the subtest sustained attention (comprising variables RT, Omission, and Commission errors) as well as standardized parent and teacher behavior ratings (Conners' *DSM*-Inattention subscale and *DSM*-Hyperactivity/Impulsivity subscale) with the QbTest factors were examined. According to the MTMM approach, we would expect significant, positive correlations between variables or factors representing the same construct (e.g., inattention) measured with different methods (e.g., rating scale vs. attention test). A significant positive correlation between those same constructs would be regarded as an indicator of concurrent validity. However, no significant correlations would be expected between different constructs (e.g., inattention vs. peer problems) assessed with different methods (e.g., rating scale vs. attention test). A low correlation between different constructs would give information on discriminant validity of the QbTest factors. The Conners' subscale Peer Relations as well as IQ scores from the German short version of the WISC-IV (Petermann & Wechsler, 2011; Sattler, 1992) were included in the correlational analysis for this reason. Except for the Inattention factor, we would expect the other QbTest factors not to be associated with either IQ or with the Conners' subscale of Peer Relations. Since Attention is a precondition for cognitive testing, we would expect the Inattention factor to be negatively correlated with IQ, but not to be correlated with the Peer Relation subscale. Finally, Pearson correlations were computed and interpreted according to Cohen (1988; small: $r \geq .1$, medium: $r \geq .3$, and large: $r \geq .5$).

Results

Exploratory Factor Analyses

The Kaiser–Mayer–Olkin Measure (KMO) of sampling adequacy was .74, indicating a good sampling adequacy (Kaiser, 1974). No QbTest variables were excluded from the analysis since only one variable showed low communality of .11 (see Table 2). According to Bühner (2006), this can be tolerated if the total sample size is high and conceptual coherence is given. The correlation matrix was subjected to principal axis factoring with oblique rotation, yielding a three-factor solution according to the scree test (factor eigenvalues: Factor 1 = 5.40, Factor 2 = 1.59, Factor 3 = 1.33).

Table 2 presents the factor loadings and communalities for the 11 QbTest variables as well as eigenvalues and percentages of explained variance for each factor in this analysis. The resulting three factors explained 76% of the total variance. The first factor accounted for 49.13% of the total variance with five QbTest variables conceptually related to motor activity/motion (i.e., Time Active, Distance, Area, Microevents, Motion Simplicity). The second factor explained 14.43% of the variance, with three variables conceptually related to inattention (i.e., Omission Errors, RT, RTVar). Finally, the third factor accounted for 12.11% of the total variance with variables conceptually related to impulsivity (i.e., Commission Errors, Multiresponse, Anticipatory). Thus, factor names were proposed according to ADHD core symptoms: Hyperactivity, Inattention, and Impulsiveness. Table 2 shows the rotated factor loadings and communality values of the QbTest.

Internal consistency of all three factors was acceptable with the following Cronbach's alpha values: Hyperactivity ($\alpha = .95$), Inattention ($\alpha = .76$), and Impulsivity ($\alpha = .60$). Correlations between factors were moderate ($.18 \geq r \leq .48$) with highest correlations occurring between Hyperactivity and Inattention ($r = .48$) and Hyperactivity and Impulsivity ($r = .39$).

Influences of Age and Gender

A MANOVA for the obtained three QbTest subscales resulted in significant main effects for gender, Wilks's Lambda = .95, $F(5, 814) = 14.49$, $p = .001$, $\eta^2 = .051$, and age, Wilks's Lambda = .63, $F(15, 2248) = 26.93$, $p = .001$,

Table 2. Rotated Factor Loadings and Communality Values (h^2) From a Principal Axis Factor Analysis of QbTest Variables Using Oblimin Rotation (N = 828)

QbTest variables	1	2	3	h^2
Factor 1: Hyperactivity				
Time active	**0.92**	0.47	0.36	0.85
Distance	**0.97**	0.44	0.39	0.94
Area	**0.97**	0.44	0.39	0.93
Microevents	**0.99**	0.46	0.38	0.99
Motion simplicity	**0.52**	0.30	0.18	0.27
Factor 2: Inattention				
Omission errors	0.52	**0.61**	0.46	0.51
Reaction time	0.40	**0.92**	−0.08	0.92
Reaction time var.	0.54	**0.93**	0.44	0.94
Factor 3: Impulsivity				
Commission errors	0.27	0.04	**0.77**	0.60
Multiresponse	0.23	0.12	**0.31**	0.11
Anticipatory	0.27	0.21	**0.75**	0.57
Eigenvalue	5.40	1.59	1.33	
% total variance	49.13	14.43	12.11	

Note: QbTest = quantified behavior test. Highest loadings are boldface.

η^2 = .14, with medium to large effect sizes according to Cohen. Thus, interpretation of these subscales is dependent on age and gender influences. Means and standard deviations for the QbTest subscales are presented separately for gender and age groups in Table 3.

Concurrent and Discriminant Validity of the QbTest Factors

Table 4 shows the Pearson correlations of the established QbTest factors with Conners' parent and teacher ratings, KITAP results, and IQ. There was some evidence supporting convergent validity of the QbTest factors. First of all, there was a significant positive correlation between the QbTest factor Hyperactivity and teacher ratings of hyperactive behavior (r = .27**, p < .01) on the Conners' *DSM*-Hyperactivity/Impulsivity subscale. Thus, the more motor activity was measured by the QbTest, the more children were rated as being hyperactive-impulsive in classroom situations by their teachers. Moreover, the QbTest factor Impulsivity was significantly correlated with low RT in the KITAP (r = −.42*, p < .05). Children who tended to react faster on the KITAP also scored high on the Impulsivity factor in the QbTest. Finally, as expected, the QbTest factor Inattention showed a significant negative correlation with IQ (r = −.27*, p < .05), meaning that children with higher IQ scores have lower scores on the QbTest Inattention factor. Despite those convergent correlations, however, there were no other significant correlations between KITAP variables and QbTest factors. Also, QbTest factors did not significantly correlate with Conners' parent ratings of inattentive or hyperactive/impulsive behavior.

Concerning discriminant validity, no significant correlations between QbTest factors Hyperactivity and Impulsivity and WISC-IV results were found that can be interpreted as an indicator of discriminant validity for those factors. Furthermore, as expected, Conners' parent and teacher ratings of Peer Relations showed no significant correlation with any of the three QbTest factors.

Discussion

The QbTest is a behavioral assessment tool in ADHD. We explored the factor structure of the QbTest children's version (6-12) in a large sample of German children referred for assessment of ADHD. An exploratory principal factor analysis yielded a three-factorial model that explained 76% of the total variance in the data. Validity analyses in a second sample of German ADHD children revealed mixed findings regarding the convergent and divergent validity of the established QbTest factors. Although the Hyperactivity factor was significantly correlated with teacher ratings of hyperactive behavior, the other two QbTest factors showed less overlap with rating measures as well as with another laboratory test for attention assessment. Since other CPTs do not separately assess the participant's motor activity, the three emerging factors and initial evidence of their concurrent validity constitute a major advantage of the QbTest. Given that validity results are heterogeneous though, further studies exploring psychometric quality and clinical utility of the QbTest are needed.

The factor structure in the presented study shows that there is one factor explaining a large amount of variance and two more factors each explaining additional unique parts of variance. From this finding, we can conclude that a participant's performance on the QbTest cannot be sufficiently described by one overall measure of performance, but instead all three factor scores must be considered. While the first factor, Hyperactivity, contained the five motor activity variables, including Time Active, Distance, Area, Microevents, and Motion Simplicity, the second factor, Inattention, consisted of the three variables Omission Errors, RT, and RT Variation, which have been frequently linked with inattention in other studies (McGee et al., 2000; Nichols & Waschbusch, 2004). The third factor, Impulsivity, contained the three variables Commission Errors, Multiresponse, and Anticipatory, which clearly show conceptual coherence with behavioral impulsivity. Particularly, commission errors have been used as an indicator for impulsivity in many studies applying CPTs (Egeland & Kovalik-Gran, 2010a, 2010b; McGee et al., 2000; Nichols & Waschbusch, 2004; Willcutt et al., 2005). Hyperactivity was the factor explaining the largest amount of variance in this sample. Apparently, the five motor activity variables

Table 3. Means (and *SD*s) for the Three QbTest Factor Scales by Gender and Age

Gender	Age	Hyperactivity	Inattention	Impulsivity	*n*
Males	6	0.88 (1.14)	1.19 (0.93)	0.42 (1.16)	83
Females		0.60 (0.87)	1.13 (0.91)	−0.13 (0.83)	27
Males	7	0.52 (0.95)	0.50 (0.79)	0.42 (1.21)	100
Females		0.28 (1.10)	0.64 (0.85)	−0.31 (0.75)	46
Males	8	0.05 (0.87)	−0.05 (0.81)	−0.04 (0.83)	112
Females		−0.23 (0.68)	0.18 (0.73)	−0.23 (0.82)	41
Males	9	−0.02 (0.96)	−0.25 (0.82)	0.11 (1.17)	113
Females		−0.46 (0.71)	−0.17 (0.67)	−0.36 (0.82)	59
Males	10	−0.45 (0.77)	−0.57 (0.78)	−0.10 (0.77)	98
Females		−0.55 (0.73)	−0.54 (0.69)	−0.47 (0.71)	42
Males	11	−0.46 (0.78)	−0.85 (0.62)	0.02 (0.98)	82
Females		−0.66 (0.78)	−0.89 (0.49)	−0.35 (0.79)	25
Males	Total	0.08 (1.02)	−0.02 (1.02)	0.13 (1.05)	588
Females		−0.20 (0.91)	0.05 (0.94)	−0.32 (0.79)	240

Table 4. Multitrait–Multimethod (MTMM) Matrix for Sample II

			QbTest factors			Conners' Parent Rating Scale			Conners' Teacher Rating Scale			KITAP			WISC–IV
Method		Trait/variable	1	2	3	4	5	6	7	8	9	10	11	12	13
QbTest factors	1	Hyperactivity	1[a]												
	2	Inattention	.38**[a]	1[a]											
	3	Impulsivity	.38**[a]	.22*[a]	1[a]										
Conners' Parent Rating Scale	4	*DSM*–Scale Inattention	−.06[b]	−.02[b]	−.04[b]	1[b]									
	5	*DSM*–Scale Hyperactive/Impulsive	.09[b]	.10[b]	.05[b]	.44**[b]	1[b]								
	6	Peer Relations	−.05[b]	−.07[b]	−.02[b]	.22*[b]	.32**[b]	1[b]							
Conners' Teacher Rating Scale	7	*DSM*–Scale Inattention	−.04[b]	.03[b]	.15[b]	.47**[b]	.23*[b]	.21*[b]	1[b]						
	8	*DSM*–Scale Hyperactive/Impulsive	.27**[b]	.17[b]	.03[b]	.03[b]	.40**[b]	.35**[b]	.39**[b]	1[b]					
	9	Peer Relations	−.12[b]	−.02[b]	−.06[b]	.03[b]	.13[b]	.39**[b]	.32**[b]	.35**[b]	1[b]				
KITAP	10	Sustained attention/ reaction time	.07[c]	−.20[c]	−.42*[c]	.26[c]	−.04[c]	.05[c]	−.41*[c]	−.02[c]	−.06[c]	1[c]			
	11	Sustained attention/ commission errors	−.04[c]	−.25[c]	−.25[c]	−.17[c]	−.19[c]	.10[c]	.00[c]	.01[c]	.22[c]	.12[c]	1[c]		
	12	Sustained attention/ omission errors	−.01[c]	.07[c]	−.21[c]	−.21[c]	.08[c]	−.06[c]	−.33[c]	.06[c]	−.14[c]	.19[c]	.44*[c]	1[c]	
WISC–IV	13	Total IQ score	−.14[d]	−.27*[d]	−.13[d]	.08[d]	.08[d]	.02[d]	.18[d]	−.10[d]	.06[d]	.02[d]	−.14[d]	.16[d]	1[d]

Note: MTMM = multitrait–multimethod; KITAP = Test of Attentional Performance for Children; WISC–IV = Wechsler Intelligence Scale for Children–Fourth edition; *DSM* = *Diagnostic and Statistical Manual of Mental Disorders*. Significant correlations indicating concurrent or discriminant validity are boldface.
[a]n = 102. [b]n = 94. [c]n = 32. [d]n = 87.
*p < .05 level (two–tailed). **p < .01 level (two–tailed).

that show extremely high factor loadings on Hyperactivity are best described in one single factor due to their high conceptual coherence. Variables constituting the Inattention and Impulsivity factor are more heterogeneous, as also shown in their lower factor loadings. Internal consistency values for all three factors were adequate to excellent. This overall result is satisfactory.

Results from the MTMM analyses yielded mixed findings for convergent and discriminant validity of the established QbTest factors. First of all, the QbTest factor Hyperactivity was significantly correlated with Conners' teacher ratings of hyperactive/impulsive behavior, indicating convergent validity for this factor. There seems to be correspondence between hyperactive behavior as measured

by the QbTest and hyperactive behavior rated by teachers. Since teacher ratings have been shown to be influenced by children's gender, ethnicity, and SES (Bussing et al., 2008), and have low reliability when monitoring symptoms over time (Rabiner et al., 2010), a valid and reliable laboratory measure for hyperactive behavior would be a welcome addition to ADHD assessment methods. Existing laboratory measures of ADHD, including former CPT versions, have limited to no ability to assess unique hyperactivity symptoms. Therefore, the factor structure presented in this study and the accordance of QbTest Hyperactivity and teacher ratings of hyperactive behavior support the combined measurement of CPT performance and motor activity as implemented in the QbTest.

While convergent validity of the established QbTest factors was partially supported by the significant correlation of the Hyperactivity factor with Conners' teacher ratings, no associations were found with Conners' parent ratings of inattentive or hyperactive-impulsive behavior. This result is in line with previous research examining differences in parent versus teacher ability to detect ADHD behaviors, showing teacher ratings to be more accurate (Tripp, Schaughency, & Clarke, 2006).

Furthermore, the Inattention factor showed a significant negative correlation with IQ meaning that children with higher IQ results had lower inattention values. Since attention is the basic behavior necessary to perform well on almost any kind of cognitive test, this result was expected. The result is interesting because it raises the question whether highly inattentive children (i.e., score high on the Inattention factor) may be underestimated by intelligence testing. Moreover, it brings up the question whether children with a higher IQ might be able to compensate deficits on CPTs. Future studies should examine whether these children often end up as "false negatives," meaning they show normal CPT results while they actually do fulfill diagnostic criteria for ADHD. Contrary to our expectations concerning the association with rating scale measures, the QbTest Inattention factor did not show significant correlations with either Conners' parent or teacher ratings of inattentive behavior. Maybe, teachers are better able to detect externalizing behavior (i.e., hyperactivity) that is highly visible in classroom situations than internalizing behavior (i.e., inattention), that normally does not disturb classroom proceedings.

We hypothesized that QbTest factors would be associated with KITAP results indicating convergent validity for the three QbTest factors. Results from the MTMM however showed no significant, positive correlations between QbTest factors and KITAP variables. Perhaps the differing levels of aggregation (factors vs. single variables) influenced the correlations. Since KITAP only reports results on single variable level, it was not possible to explore correlations on factor/trait level.

Results regarding discriminant validity were promising since QbTest factors did not significantly correlate with either Conners' parent or teacher ratings of peer problems. Also, as expected, the QbTest factors Impulsivity and Hyperactivity did not correlate with IQ in the WISC-IV.

Overall, results regarding the validity of the established QbTest factors were heterogeneous. Reports of low to nonexistent correlations between laboratory measures and behavior rating measures of ADHD symptomatology are not unusual. Previous studies examining the relationship of CPTs and behavior ratings for ADHD have repeatedly failed to find significant intercorrelations for parent as well as teacher ratings (DuPaul, 1991; Edwards et al., 2007). Among other investigators, Barkley (1991) has challenged the ecological validity of laboratory measures of ADHD symptoms primarily because of the low to moderate correlations CPT measures have been shown to have with ratings of behavior problems. Others who have studied activity levels in children engaged in a CPT have stated that the CPT setting in fact imitates a classroom situation in which children are for most of the time required to remain seated and to engage in a given task (Reichenbach, Halperin, Sharma, & Newcorn, 1992; Teicher et al., 1996). It has been speculated that one reason for those inconsistent findings might be low correspondence between ratings of behavior and constructs measured by CPTs (Edwards et al., 2007). Behavior ratings on one hand can be seen as an impression that is based on the accumulation of behavior in a certain period of time that occurs in real-life situations (i.e., classroom or home). CPTs on the other hand explore and report behavior in a very specific moment in a laboratory setting. It may be that low correlations repeatedly found for these measures can be explained by the fact that these very different methods simply measure different aspects of behavior. We would expect similar measures like two different CPT versions to show significant, positive correlations then. However, as described above, results from the MTMM showed no significant, positive correlations between QbTest factors and KITAP variables.

In a current study that is in preparation, the predictive value of the QbTest together with the other variables in this study (i.e., Conners' Rating Scales, KITAP, IQ Scores) will be examined in a set of ADHD patients and healthy matched controls to further evaluate the diagnostic utility of the QbTest.

Additional results of this study are in accordance with key findings of the ADHD literature. First, as expected, gender significantly influenced ADHD symptom severity in Sample I. Moderating effects of gender on ADHD symptomatology have been repeatedly reported in the literature. Girls are more likely to be inattentive and show more internalizing problems but less disruptive behavior compared with boys and are therefore at risk of being under-identified (Berry, Shaywitz, & Shaywitz, 1985; Gershon, 2002). In addition, in a meta-analytic review, Hasson and Fine (2012)

found gender to be a significant moderating factor when using CPTs for ADHD assessment with gender effects being more pronounced for impulsivity than for inattention. We replicated those findings from Hasson and Fine (2012), as in our study, gender effects were also most evident for the Hyperactivity and the Impulsiveness subscales and less so for the Inattention subscale. Behavioral assessment measures with separate norms for boys and girls may be an option to reduce gender bias in the diagnostic process.

Second, consistent with the literature (Brocki et al., 2008), age also affected ADHD symptom scores measured with the QbTest. Across all three subscales, QbTest scores decreased with age, highlighting the necessity of age-specific norms as provided by the QbTest.

While assessment of the factorial structure and its concurrent and discriminant validity is an essential first step in evaluating the overall validity of the QbTest, several further issues need to be addressed before the test can be regarded as a well-validated screening and/or diagnostic tool for childhood ADHD. In particular, further research needs to clarify whether the test adequately distinguishes between children with and without ADHD and between children with ADHD and other disorders such as anxiety, depression, and autism spectrum disorder. This is particularly important given the high comorbidity rates between ADHD and these disorders (APA, 2000). Also, it would be desirable for future studies to compare different ADHD subtypes with regard to their QbTest factor scores. As ADHD children constitute a highly heterogeneous group, a significant task for future research is to match different CPT versions with different ADHD subtypes. Altogether the factor-analytic and correlational results presented in this study may indicate that the QbTest is particularly fit to assess children from the predominantly hyperactive as well as the combined hyperactive/impulsive subtype. This will have to be further explored in subsequent psychometric studies on the QbTest. Finally, although some research on QbTest's sensitivity to detect treatment effects is available (Vogt & Williams, 2011; Wehmeier et al., 2011; Wehmeier et al., 2012), further research regarding this topic is needed.

Limitations

Although the results presented in this study show initial evidence for the utility of the QbTest, some important limitations have to be considered. First, the sample used for factor analyses in this study lacks cases in the 12-year-old category, resulting in an age range that did not include all age groups the QbTest is targeting at. Moreover, since the sample analyzed here consisted of a convenience sample of children referred for ADHD assessment, the sample included children with a wide range of severity of ADHD symptoms. Also, information on the existing comorbidity as well as the ADHD subtype was not available for analysis.

Second, several variables in our factor analysis showed high loadings on more than one factor. The variable Omission Errors for instance loaded high on Inattention but also significantly on Hyperactivity. This variable does not seem to differentiate well between the two different symptom clusters. The variable Multiresponse also had a low communality value and showed moderate loadings on all three factors with the highest loading on Impulsivity. Although the question arises whether these two variables should be removed from the test, the variable Omission Errors is conceptually important and has been consistently interpreted as a measure of inattention in previous CPT research (Halperin, Wolf, Greenblatt, & Young, 1991; Nichols & Waschbusch, 2004). Omission errors have been shown to be related to aspects of attention but significantly less to hyperactive/impulsive behavior and thus comprise differential information (Egeland & Kovalik-Gran, 2010b). We therefore believe that the variable Omission errors should remain in the test, and its classification within the Inattention factor is justifiable. The low factor loadings of Multiresponse can be explained by limited variance of this variable. Since only the most impulsive children press more than one time to a given stimulus, this leads to a restriction of variance and thus low factor loadings. Despite those mathematical issues, the variable Multiresponse could be of clinical use to identify extreme cases of impulsivity and should therefore remain in the test as well.

Finally, a diagnosis is always made by a clinician who must interpret and integrate different diagnostic results. Therefore it is important to note that as far as construction and implementation of rigorously designed and reliable tests can help us avoid subjective biases in the diagnostic process, the role of subjective interpretation of test results must be considered.

Conclusion

The QbTest is a behavioral assessment tool for ADHD that is increasingly being used in research and clinical settings across many different Western countries. This study is the first to examine the factorial structure and validity of the QbTest. Overall, the results show that the single QbTest variables meaningfully group together and that there is initial evidence for concurrent validity of each of the three emerging factors. However, low correlations with the Conners' Parent Rating Scales and another laboratory test for attention assessment point to the need for extended research on the psychometric quality of the QbTest. Also additional research needs to further clarify the underlying constructs captured by CPTs in general and whether QbTest may be particularly beneficial in the behavioral assessment of the predominantly hyperactive as well as the hyperactive/impulsive ADHD subtype.

Acknowledgment

We thank all children and their parents for participation. We also thank the anonymous reviewer for helpful and constructive comments on our manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Note

1. We will refer to the QbTest version for children aged 6 to 12 throughout the article.
2. The QbTest has been approved by the Food and Drug Administration (FDA) in 2012.

References

American Academy of Child & Adolescent Psychiatry. (2007). Practice parameter for the assessment and treatment of children and adolescents with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *46*, 894-921.

American Academy of Pediatrics. (2000). Clinical practice guideline: Diagnosis and evaluation of the child with attention-deficit/hyperactivity disorder. *Pediatrics*, *105*, 1158-1170.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

Ballard, J. C. (1996). Computerized assessment of sustained attention: A review of factors affecting vigilance performance. *Journal of Clinical and Experimental Neuropsychology*, *18*, 843-863.

Barkley, R. A. (1991). The ecological validity of laboratory and analogue assessment methods of ADHD symptoms. *Journal of Abnormal Child Psychology*, *19*, 149-178.

Berry, C. A., Shaywitz, S. E., & Shaywitz, B. A. (1985). Girls with attention deficit disorder: A silent minority? A report on behavioral and cognitive characteristics. *Pediatrics*, *76*, 801-809.

Brocki, K. C., Tillman, C. M., & Bohlin, G. (2008). CPT performance, motor activity, and continuous relations to ADHD symptom domains: A developmental study. *European Journal of Developmental Psychology*, *7*, 178-197.

Bühner, M. (2006). *Einführung in die Test- und Fragebogenkonstruktion* [An Introduction to Test- and Questionnaire Construction] (2nd ed.). München, Germany: Pearson Studium.

Bussing, R., Fernandez, M., Harwood, M., Wei, H., Garvan, C. W., Eyberg, S. M., & Swanson, J. M. (2008). Parent and teacher SNAP-IV ratings of attention deficit hyperactivity disorder symptoms. *Assessment*, *15*, 317-328.

Chen, W., & Taylor, E. A. (2006). Parental account of children's symptoms (PACS), ADHD phenotypes and its application to molecular genetic studies. In R. D Oades (Ed.) *Attention-deficit/hyperactivity disorder and hyperkinetic syndrome: current ideas and ways forward* (pp. 3-20). Hauppauge, NY: Nova Science Publisher.

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*. New York, NY: Academic Press.

Cohen, J. (1988). *Statistical power and analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Conners, C. K. (2008). *Conners 3rd edition: Manual*. Toronto, Ontario, Canada: Multi-Health Systems.

Corkum, P. V., & Siegel, L. S. (1993). Is the continuous performance task a valuable research tool for use with children with attention-deficit-hyperactivity disorder? *Journal of Child Psychology and Psychiatry*, *34*, 1217-1239.

Delmo, C., Weiffenbach, O., Gabriel, M., Stadler, C., & Poustka, F. (2001). *Übersetzung und Adaptation des Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime* (K-SADS-PL). Retrieved from http://www.adhs-legasthenie.de/PDF/K-SADS_Fragebogen.pdf (Original work published 2000)

DuPaul, G. J. (1991). Parent and teacher ratings of ADHD symptoms: Psychometric properties in a community-based sample. *Journal of Clinical Child Psychology*, *20*, 245-253.

Edwards, M., Gardner, E., Chelonis, J., Schulz, E., Flake, R., & Diaz, P. (2007). Estimates of the validity and utility of the Conners' Continuous Performance Test in the assessment of inattentive and/or hyperactive-impulsive behaviors in children. *Journal of Abnormal Child Psychology*, *35*, 393-404.

Egeland, J., & Kovalik-Gran, I. (2010a). Validity of the factor structure of Conners'™ CPT. *Journal of Attention Disorders*, *13*, 347-357.

Egeland, J., & Kovalik-Gran, I. (2010b). Measuring several aspects of attention in One Test. *Journal of Attention Disorders*, *13*, 339-346.

Epstein, J. N., Erkanli, A., Conners, C. K., Klaric, J., Costello, J. E., & Angold, A. (2003). Relations between Continuous Performance Test Performance Measures and ADHD behaviors. *Journal of Abnormal Child Psychology*, *31*, 543-554.

Forbes, G. B. (1998). Clinical utility of the test of variables of attention (TOVA) in the diagnosis of attention-deficit/hyperactivity disorder. *Journal of Clinical Psychology*, *54*, 461-476.

Gershon, J. (2002). A meta-analytic review of gender differences in ADHD. *Journal of Attention Disorders*, *5*, 143-154.

Gualtieri, C. T., & Johnson, L. G. (2005). ADHD: Is objective diagnosis possible? *Psychiatry (Edgmont)*, *2*, 44-53.

Günther, T. (2012). *Questionnaires versus computer-based assessments to examine attentional processes*. Poster presentation during the 3rd UK Paediatric Neuropsychology Symposium: Early Brain-Behaviour Relationships & Prognostic Indicators, London, UK.

Halperin, J. M., Newcorn, J. H., Sharma, V., Healey, J. M., Wolf, L. E., Pascualvaca, D. M., & Schwartz, S. (1990). Inattentive and noninattentive ADHD children: Do they constitute a unitary group? *Journal of Abnormal Child Psychology*, *18*, 437-449.

Halperin, J. M., Wolf, L., Greenblatt, E. R., & Young, G. (1991). Subtype analysis of commission errors on the continuous performance test in children. *Developmental Neuropsychology*, *7*, 207-217.

Hasson, R., & Fine, J. G. (2012). Gender differences among children with ADHD on Continuous Performance Tests. *Journal of Attention Disorders*, *16*, 190-198.

Kaiser, H. (1974). An index of factorial simplicity. *Psychometrika*, *39*, 31-36.

McGee, R. A., Clark, S. E., & Symons, D. K. (2000). Does the Conners' Continuous Performance Test Aid in ADHD Diagnosis? *Journal of Abnormal Child Psychology*, *28*, 415-424.

Nichols, S. L., & Waschbusch, D. A. (2004). A review of the validity of laboratory cognitive tasks used to assess symptoms of ADHD. *Child Psychiatry & Human Development*, *34*, 297-315.

Oades, R. D., Dauvermann, M. R., Schimmelmann, B. G., Schwarz, M. J., & Myint, A. M. (2010). Attention-deficit hyperactivity disorder (ADHD)and glial integrity: S100B, cytokines and kynurenine metabolism—Effects of medication. *Behavioral and Brain Functions*, *6*, 29.

O'Brien, J. D., Halperin, J. M., Newcorn, J. H., Sharma, V., Wolf, L., & Morganstein, A. (1992). Psychometric differentiation of conduct disorder and attention deficit disorder with hyperactivity. *Journal of Developmental & Behavioral Pediatrics*, *13*, 274-277.

Petermann, F., & Wechsler, D. (2011). *Wechsler Intelligence Scale for Children (WISC-IV)* (4th ed., German Version). Frankfurt/M, Germany: Pearson.

Polanczyk, G., de Lima, M. S., Horta, B. L., Biederman, J., & Rohde, L. A. (2007). The worldwide prevalence of ADHD: A systematic review and metaregression analysis. *American Journal of Psychiatry*, *164*, 942-948.

Rabiner, D. L., Murray, D. W., Rosen, L., Hardy, K., Skinner, A., & Underwood, M. (2010). Instability in teacher ratings of children's inattentive symptoms: Implications for the assessment of ADHD. *Journal of Development & Behavioral Pediatrics*, *31*, 175-180.

Reichenbach, L. C., Halperin, J. M., Sharma, V., & Newcorn, J. H. (1992). Children's motor activity: Reliability and relationship to attention and behavior. *Developmental Neuropsychology*, *8*, 87-97.

Riccio, C. A., Waldrop, J. J., Reynolds, C. R., & Lowe, P. (2001). Effects of stimulants on the continuous performance test (CPT): Implications for CPT use and interpretation. *Journal of Neuropsychiatry and Clinical Neurosciences*, *13*, 326-335.

Sattler, J. M. (1992). *Assessment of children: behavioral and clinical applications*. San Diego, CA: Sattler Publisher.

Scholtens, S., Diamantopoulou, S., Tillman, C. M., & Rydell, A.-M. (2011). Effects of symptoms of ADHD, ODD, and cognitive functioning on social acceptance and the positive illusory bias in children. *Journal of Attention Disorders*. Advance online publication.

Stein, D. S., Blum, N. J., & Barbaresi, W. J. (2011). Developmental and behavioral disorders through the life span. *Pediatrics*, *128*, 364-373.

Taylor, E., Döpfner, M., Sergeant, J., Asherson, P., Banaschewski, T., Buitelaar, J., & Zuddas, A. (2004). European clinical guidelines for hyperkinetic disorder—First upgrade. *European Child & Adolescent Psychiatry*, *13*, i7-i30.

Teicher, M. H., Ito, Y., Glod, C. A., & Barber, N. I. (1996). Objective measurement of hyperactivity and attentional problems in ADHD. *Journal of the American Academy of Child & Adolescent Psychiatry*, *35*, 334-342.

Tripp, G., Schaughency, E. A., & Clarke, B. (2006). Parent and Teacher Rating Scales in the evaluation of attention-deficit hyperactivity disorder: Contribution to diagnosis and differential diagnosis in clinically referred children. *Journal of Developmental & Behavioral Pediatrics*, *27*, 209-218.

Ulberstad, F. (2012). *QbTest Technical Manual* (rev. ed.). Stockholm, Sweden: Qbtech AB.

Vogt, C., & Williams, T. (2011). Early identification of stimulant treatment responders, partial responders and non-responders using objective measures in children and adolescents with hyperkinetic disorder. *Child and Adolescent Mental Health*, *16*, 144-149.

Wehmeier, P. M., Dittmann, R. W., Banaschewski, T., & Schacht, A. (2012). Does stimulant pretreatment modify atomoxetine effects on core symptoms of ADHD in children assessed by quantitative measurement technology? *Journal of Attention Disorders*. Advance online publication.

Wehmeier, P. M., Schacht, A., Wolff, C., Otto, W. R., Dittmann, R. W., & Banaschewski, T. (2011). Neuropsychological outcomes across the day in children with attention-deficit/hyperactivity disorder treated with atomoxetine: Results from a placebo-controlled study using a computer-based Continuous Performance Test combined with an infra-red motion-tracking device. *Journal of Child and Adolescent Psychopharmacology*, *21*, 433-444.

Willcutt, E. G., Doyle, A. E., Nigg, J. T., Faraone, S. V., & Pennington, B. F. (2005). Validity of the executive function theory of attention-deficit/hyperactivity disorder: A meta-analytic review. *Biological Psychiatry*, *57*, 1336-1346.

Zimmermann, P., Gondan, M., & Fimm, B. (2002). *Testbatterie zur Aufmerksamkeitsprüfung für Kinder (KITAP)* [Test of Attentional Performance for Children]. Herzogenrath, Germany: Psytest.

Bios

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D. Curriculum Vitae und Publikationsliste

Die Seiten 103 – 106 sind in der Online-Veröffentlichung nicht enthalten.

E. Eidesstattliche Erklärung

Ich versichere, dass ich meine Dissertation „**Evaluation psychometrischer Verfahren zur Verbesserung der Diagnostik von ADHS im Kindes-, Jugend- und Erwachsenenalter“** selbständig, ohne unerlaubte Hilfe angefertigt und mich dabei keiner anderen als der von mir ausdrücklich bezeichneten Quellen und Hilfen bedient habe. Die Dissertation wurde noch bei keiner anderen Hochschule eingereicht und hat noch keinen sonstigen Prüfungszwecken gedient. Die Artikel „**Assessment of ADHD symptoms and the Issue of Cultural Variation: Are Conners^{3ed} Rating Scales Applicable to Children and Parents With Migration Background?“** unter Erstautorenschaft von Martin Schmidt und **„Behavioral Assessment of Core ADHD Symptoms using the QbTest“** unter Erstautorenschaft von Verena Reh, waren Teil der Dissertation **„Fragebögen und neuropsychologische Verfahren bei ADHS – Wege zur Verbesserung der Diagnostik?“** von Dr. Verena Reh-Müller.

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Marburg, 04.02.2017 Martin Schmidt